

Perspective Plan for Land Resources for Western Region of Uttar Pradesh -

(iii)

Assistance was extended by Dr. K.S. Yadava and Shri Chandra Shekhar Tewari in preparation of maps and Shri Rajiv Saxena and Shri P.K. Srivastava in computer processing. Shri Devanand has carried out the task of preparing the typescript with speed and efficiency.

Finally, I would like to express my sincere thanks to the Director and the Secretarial, Accounts and Library Staff of our Institute for providing necessary infrastructural support for completing the project.

It is hoped that the study will help in evolving action plans and policy interventions in conserving and developing our precious land resources.

AJIT KUMAR SINGH

Giri Institute of Development Studies
Lucknow

November 30, 1992.

24654



CONTENTS

		Foreword	(i) - (iii)
		List of Maps	(vii)
CHAPTER	I	THE PHYSICAL SETTING	1 - 10
		I.1 Location and Area	1
		I.2 Physiography	2
		I.3 Drainage	2
		I.4 Ground Water	4
		I.5 Climate	5
		I.6 Rainfall	5
		I.7 Soils	7
		I.8 Natural Vegetation	9
		I.9 Agro-climatic Zones	9
CHAPTER	II	DEMOGRAPHIC AND ECONOMIC SITUATION	11 - 30
		II.1 Population Structure	11
		II.2 Population Density	13
		II.3 Population Growth	14
		II.4 Population Projections	19
		II.5 Work Force and Structure	23
		II.6 Trends in Output and Income	26
		II.7 Income Projections	28
CHAPTER	III	DEMAND PROJECTIONS	31 - 39
		III.1 Methodology	31
		III.2 Alternative Demand Projections	32
		III.3 Normative Requirements	34
		III.4 District Level Projections	38

CHAPTER	IV	OUTPUT AND YIELD TRENDS AND SUPPLY POSSIBILITIES	40	-	56
	IV.1	Trends in Output	40		
	IV.2	Trends in Average Yields	43		
	IV.3	Projected Demand and Supply	48		
	IV.4	Supply Possibilities	50		
CHAPTER	V	LIVESTOCK RESOURCES	57	-	70
	V.1	Introduction	57		
	V.2	Livestock Number and Density	57		
	V.3	Growth of Livestock	60		
	V.4	Livestock Output	62		
	V.5	Fodder Requirement and Availability	63		
	V.6	Strategy of Livestock and Fodder Development	70		
CHAPTER	VI	LAND USE PATTERN AND TRENDS	71	-	91
	VI.1	Introduction	71		
	VI.2	Regional Level Land Use Pattern	71		
	VI.3	Regional Level Trends In Land Use	73		
	VI.4	District Level Pattern of Land Use	76		
	VI.5	District Level Trends In Land Use	80		
	VI.6	Conclusion	90		
CHAPTER	VII	CROPPING INTENSITY AND CROPPING PATTERN	92	-	105
	VII.1	Cultivable Area and Its Exploitation	92		
	VII.2	Intensity of Cropping	94		
	VII.3	Cropping Pattern	96		
	VII.4	Shifts In The Cropping Pattern	100		
	VII.5	Conclusion	104		

CHAPTER	VIII	IRRIGATION AND WATER RESOURCES	106 - 123
	VIII.1	Introduction	106
	VIII.2	Irrigation Trends and Sources	107
	VIII.3	Surface Water Potential and Exploitation	113
	VIII.4	Ground Water Potential and Exploitation	117
	VIII.5	Conclusion	121
CHAPTER	IX	FOREST RESOURCES	124 - 134
	IX.1	Introduction	124
	IX.2	Forest Cover	124
	IX.3	Forest Types	127
	IX.4	Forest Status	128
	IX.5	Forest Produce	128
	IX.6	Forest Development and Conservation	131
CHAPTER	X	WASTELAND DEVELOPMENT	135 - 145
	X.1	Introduction	135
	X.2	Estimates of Wastelands	135
	X.3	Types of Wastelands	140
	X.4	Wasteland Reclamation	141
	X.5	Approach To Wasteland Development	143
CHAPTER	XI	SUMMARY AND SUGGESTIONS	146 - 163

Maps

LIST OF MAPS

I.1	Administrative Divisions
I.2	Physiography
I.3	Temperature
I.4	Rainfall
I.5	Soils
II.1	Population Density
II.2	Per Capita Net Area Sown
III.1	Per Capita Output of Foodgrains (Total)
III.2	Per Capita Output of Foodgrains (Rural)
IV.1	Average Yield
IV.2	Value of Agricultural Output Per Hectare
VI.1	Area Under Forests
VI.2	Area Under Non-Agricultural Uses
VI.3	Barren and Unculturable Land
VI.4	Permanent Pastures and Other Grazing Land
VI.5	Cultivable Wasteland
VI.6	Land Under Miscellaneous Trees and Groves
VI.7	Current Fallow Land
VI.8	Other Fallow Land
VI.9	Net Sown Area As Per cent of Reported Area
VI.10	Change in Cultivable Wasteland
VI.11	Change in Area Under Non-Agricultural Uses
VII.1	Cultivable Area As Per cent of Reported Area
VII.2	Net Area Sown As Per cent of Cultivable Area
VII.3	Intensity of Cropping
VII.4	Area Under Foodgrains As Per cent of Cropped Area
VII.5	Area Under Wheat As Per cent of Cropped Area
VII.6	Area Under Paddy As Per cent of Cropping Area
VIII.1	Net Area Irrigated As Per cent of Net Sown Area
VIII.2	Gross Area Irrigated As Per Cent of Gross Cropped Area
VIII.3	Tubewells Per 1000 Hectares of Net Sown Area
VIII.4	Average Depth of Ground Water Level
VIII.5	Variation In Ground Water Depth
VIII.6	Ground Water Utilization
X.1	Culturable Wasteland As Percent of Reported Area Based on NRSA Maps
X.2	Wasteland Map

CHAPTER I

THE PHYSICAL SETTING

I.1 Location and Area

The western region of U.P. comprises 21 districts situated in the north western part of the state. The region falls between 26° and 30° N latitude and 77° and 80° E longitude. It is bounded by U.P. Hill region in the north, central region of U.P. in the east, Union Territory of Delhi and the states of Haryana and Rajasthan on the west and the states of Rajasthan and Madhya Pradesh in the south. Total area of the region is 82,189 sq.Km. The population according to 1991 Census was 49.40 million. The region accounts of 27.9 per cent of the area of the State and 35.6 per cent of its total population. Map I.1 shows the location of the western region of U.P. and its administrative divisions.

The twenty one districts comprising the Western Region of U.P. fall in 5 divisions²:

Meerut Division	:	Bulandshahr, Ghaziabad, Haridwar, Meerut, Muzaffarnagar and Saharanpur
Agra Division	:	Agra, Aligarh, Etah, Ferozabad, Mainpuri and Mathura
Moradabad Division	:	Bijnor, Moradabad and Rampur

1. The description of the various physical features of the western region of U.P. in this Chapter is based on various government publications and draws heavily on the book India : A Regional Geography edited by R.L. Singh (National Geographic Society of India, Varanasi, 1971).

2. In 1988-89 the State Government has created two new districts of Ferozabad and Hardwar. However, our analysis pertains to the original 19 districts for which time series data is available.

Bareilly Division	:	Bareilly, Budaun, Pilibhit and Shahjahanpur
Kanpur Division	:	Etawah and Farrukhabad

There are 87 tehsils and 265 development blocks in the region. The region is fairly well urbanised with 297 towns and town-groups. The number of inhabited villages in the region is 27,528. District-wise details on these aspects are given in Table I.1.

1.2 Physiography

The Western Region of U.P. falls in the upper Gangetic plains comprising highly fertile alluvium track of Pleistocene and recent deposits of clay and sand. With an average relief between 80 m. and 250 m. the seemingly endless Gangetic Plain presents an almost featureless topography the monotony of which is broken by numerous ponds, lakes and rivers. The tarai-bhabar zone along the northern foothills has a distinct topography. Bhabar is the narrow belt skirting the Siwaliks, where the rivers suddenly flatten out and deposit the coarser boulders and gravels. Tarai constitutes the marshy track covered with forests and grasses, a large part of which has been reclaimed for cultivation purposes. Another topographically noteworthy track is the ravine landscape along the lower reaches of the rivers Yamuna and Chambal. Map 1.2 shows the average relief in the region.

Table I.1 : Districtwise Number of Tehsils, Development Blocks, Inhabited Villages and Towns in Western U.P.

Districts	Tehsils (1988)	Development Blocks (1988)	Inhabited Villages (1981)	Towns and Town Groups (1981)
Agra	7	18	1174	14
Aligarh	6	17	1704	20
Bareilly	5	15	1901	18
Bijnor	5	11	2134	15
Budaun	5	18	1765	22
Bulandshahr	4	17	1365	22
Etah	5	15	1310	15
Etawah	4	14	1462	12
Farrukhabad	4	14	1377	11
Ghaziabad	4	10	704	13
Meerut	4	18	920	23
Mainpuri	5	15	1371	11
Mathura	4	12	867	15
Moradabad	6	19	2473	19
Muzaffarnagar	4	14	852	18
Pilibhit	3	7	1198	6
Rampur	5	6	1042	8
Saharanpur	3	11	1265	16
Shahjahanpur	4	14	2124	10
Western Region	87	265	27528	299

Source : Statistical Diary U.P. 1989, U.P. Government.

of the Ganga. The entire region is criss crossed by numerous streams dividing the area into several big and small doabs. Most of the rivers flowing through the region originate in the Himalayas (e.g. Ganga, Yamuna, Ram Ganga), while some originate in the marshy depression of Tarai and Bhabar (e.g. Kali West) or in the depressions in the bangar tract (e.g. Kali East, Soti, Sai).

The drainage of the Gangetic region is dendritic with parallel courses and acute angle junctions of tributaries with their master streams. Most of the rivers are perennial streams with well defined courses and gentle gradients. The direction of flow is north-west and south-east. The main streams provide water to canals some of them over 100 years old, and are suitable for navigation purposes.

Seasonal fluctuations in the flow of water is a characteristic feature as rivers become swollen in the monsoons. Wide flood plains and high banks are common features of the Ganga and the Yamuna, while Ram Ganga has an ill defined course. The Chambal, a tributary of Yamuna originating in Madhya Pradesh, is known for creating severe land degradation with its ravine landscape.

1.4 Ground Water

The Gangetic plains are rich in ground-water resources both free and confined. The confined aquifers generally strike between 60-90 m. while free aquifers are found within 30 m. depth. The ground water is generally available in most parts of the region at a shallow depth of 4-8 meters. The water table is generally higher in the clayey bangar region as compared to the

riverine khadar tracts. In the vicinity of Yamuna and Chambal rivers the water table is above 12 m. After the monsoons there is a general rise of water table of the order of 1 to 3 m. A saline water tract is found in Mathura and Agra districts. The entire region is dotted with a large number of tubewells and other wells extensively used for irrigation purposes.

1.5 Climate

Western U.P. has a sub-humid climate falling between the dry Punjab plain and the humid middle Ganga Plain. The climate is affected by the proximity to the Himalayas. The temperature which comes down to near freezing point in winter nights shoots up to over 45° celsius in the summer months. The average temperature is lower in the northern and western parts of the region as compared to the south-eastern parts (see Map I.5).

The three distinct seasons are the summer season (March to mid-June), the monsoon season (mid-June to September) and the winter season. The summer season is the hottest part of the year marked by low humidity and strong and scorching hot and dust laden winds called 'loo'. During the monsoon season there is a sudden fall in temperature and an abrupt rise in humidity. The winter season is characterised by cool weather and clear sky. Chilly conditions develop occasionally and foggy conditions prevail over some tracts.

1.6 Rainfall

Western Zone receives on average 96 mm of annual rainfall. Nearly 90 per cent of the rainfall occurs during the monsoon

period (see Table 1.2). There are, however, marked intra-regional variations in rainfall as can be seen from Table 1.3 and Map 1.4. In general rainfall increases from west to east and from south to north making the south-western part the driest zone of the region.

Table 1.2 : Rainfall Characteristics of western Meteorological Division of U.P.

Month	Normal Rainfall (in Cms.)	Normal Rainy Days (Nos.)	C.V. of Rainfall (%)
January	2	2	54
February	3	2	57
March	1	1	99
April	1	0.3	112
May	1	1	75
June	9	4	55
July	29	12	31
August	29	12	33
September	17	7	61
October	3	1	147
November	1	0.3	203
December	1	0.3	121
Annual	96	44	17
Rainy Season	84	35	22

Source : Government of India, Report of the National Commission on Agriculture, Part IV, Climate and Agriculture. New Delhi, 1976.

The monsoon rains are necessary for sowing and early growth of Kharif crops while winter rains help the growth of the rabi crops. While annual precipitation can be regarded as moderate in most parts of the region, it is subject to a high degree of variability. Prolonged dry spells cause drought conditions. However, the impact of the weather conditions is considerably

mitigated by the highly developed irrigation facilities in the region.

1.7 Soils

Soils of the region are by and large homogeneous with most parts covered by alluvial soil (Map 1.5 and Table 1.3). The important variations to be observed are between the khadar and the bangar soils. The low lying khadar soils are found in the siltation tracts of the flood plains of the rivers. Sandy to loamy in texture they are rich in plant nutrients. Bangar soils found in the interfluvial zone are more extensive in area. These are clayey in texture. Patches of saline soils called usar or ran are also found in a number of districts (e.g. Aligarh, Etah, Etawah, Ghaziabad, Meerut and Mathura). Sandy bhur soils are found along the tract of Ganga and Ram Ganga. Medium black soils occur in part of Agra district and brown hill soils in Saharanpur district. Another soil variant to be noted is the terai soil found in a narrow elongated tract in the foothills covering parts of Bijnor, Bareilly and Pilibhit districts. This soil is clayey in texture and rich in humus.

Organic matter and soil nitrogen is low in most of the districts. In phosphorous content the districts generally fall in the medium or low category, while in potassium contents they fall in the medium category.¹

1. See P.S. Tewari, Agricultural Atlas of Uttar Pradesh. Plate 13. G.B. Pant University of Agriculture and Technology, Pantnagar, 1973.

Table I.3 : Physiographic Characteristics of Western U.P.

District	Area (Sq.Km.)	Annual Rain- fall (Cm.)	Soil Type
Agra	4805	65.6	Alluvial, Medium Black
Aligarh	5019	66.3	Alluvial, Saline
Bareilly	4120	110.7	Alluvial
Bijnor	4848	108.8	Alluvial
Budaun	5168	82.1	Alluvial
Bulandshahr	4352	67.4	Alluvial
Etah	4446	69.5	Alluvial, Saline
Etawah	4326	75.2	Alluvial, Saline
Farrukhabad	4274	79.3	Alluvial
Ghaziabad	2590	72.0	Alluvial, Saline
Meerut	3911	72.0	Alluvial
Mainpuri	4343	71.4	Alluvial
Mathura	3811	59.3	Alluvial, Saline
Moradabad	5967	94.4	Alluvial
Muzaffarnagar	4176	75.9	Alluvial
Pilibhit	3499	124.2	Alluvial
Rampur	2367	110.7	Alluvial
Saharanpur	5595	94.9	Brown Hills
Shahjahanpur	4575	102.0	Alluvial

Source : Statistical Diary of Uttar Pradesh and Indian Agriculture in Brief

1.8 Natural Vegetation

The region once covered with thick natural forests has been practically denuded of its forest wealth for purposes of cultivation and settlement. Whatever little forests remain are confined to the terai districts of Saharanpur, Bijnor and Pilibhit in the north and Agra and Etawah district in south. In remaining districts forest cover is minimal. Tropical moist deciduous forests are found in the northern terai region with sal as the major specie. In the other parts sub-tropical dry forests occur, where shisham, babul, khair and samal are the main species.

1.9 Agro-Climatic Zones

Though the entire west U.P. falls in the upper Gangetic plains, there are noticeable differences in climate, temperature and other physical features as already indicated. According to the scheme of agro-climatic zones adopted recently by the Planning Commission for purposes of planning districts comprising the western region of U.P. which fall under zone 5 (Upper Gangetic Plains Region) can be classified in two sub-zones, namely, North-West U.P. Plain Division and South Western U.P. Plain Division.¹ The coverage of these two sub-zones is indicated below :

<u>North-West U.P. Plain Division</u>	: Bareilly, Bijnor, Bulandshahr, Ghaziabad, Meerut, Moradabad, Muzaffarnagar, Rampur, Saharanpur and Shajahanpur
<u>South-Western U.P. Plain Division</u>	: Agra, Aligarh, Budaun, Etah, Etawah, Farrukhabad, Mainpuri and Mathura

1. For details see Planning Commission, Agro-Climatic Zones & Profiles and Issues, Agro-Climatic Regional Planning Unit, Working Paper No.2, Ahmedabad, 1989.

According to this scheme Pilibhit district of West U.P. falls in the Central U.P. Plain Division, while Kanpur district of Central U.P. is classified with districts of south-western U.P. plain division. We feel that on administrative considerations Pilibhit may be included in the North West U.P. Plain Division, whereas Kanpur district can be included in the Central U.P. Plains Division. We are further of the view that for purposes of planning the development and management of land resources the differences in the two sub-zones have to be taken into account rather than treating the whole of west U.P. as a homogeneous region.

CHAPTER II

DEMOGRAPHIC AND ECONOMIC SITUATION

II.1 Population Structure

According to the Census of 1991 total population of Western Region of U.P. was 494.0 lakhs. Thus 35.6 per cent of the state population lives on 27.9 per cent of the state area in this region. Though the region is predominantly rural like rest of the state with 76.2 per cent of the population living in the rural areas, the degree of urbanisation is relatively higher - 23.8 per cent against the state average of 18.0 per cent (Table II.1). Female population is only 45.8 per cent giving a sex ratio of 843 as compared to 882 in U.P. as a whole. Scheduled castes population constitutes slightly less than one-fifth of the total population. The population of the scheduled tribes in the region is almost negligible. 42.4 per cent of the population in the region is below 15 years of age, while 51.1 per cent is in the working age group of 15-59 years. The literacy rates are disappointingly low as in rest of the state - 33.7 per cent for total population, 44.0 per cent for male population and 20.9 per cent for female population. Thus, even though the region is known as a developed region economically, in social development it is lagging behind.

Table II.2 gives districtwise data on population size and density. The population size ranges between 11.23 lakhs in Hardwar to 34.04 lakhs in Meerut. The proportion of rural

population varies from 61.1 per cent in Agra to 58.9 per cent in Mainpuri. Thus, in general the degree of urbanisation in the region is quite low.

Table II.1 : Population Characteristics of Western Region, 1991

(Figures in lakhs)

Item	Western Region	Uttar Pradesh	Western Region as % of U.P.
Total Population	494.0	1387.6	35.6
Density of Population (Persons Per Sq.Km.)	601	471	127.6
Sex Ratio	843	882	95.6
Urban Population (%), 1981	23.8	18.0	132.2
Scheduled Castes & Tribes (%), 1981	18.7	21.4	87.4
Age Structure (%), 1981			
(i) Below 15	42.4	41.7	101.6
(ii) Between 15-59	51.1	51.1	100.0
(iii) Above 60	6.5	6.8	95.6
Literacy Rate (%), 1981			
(i) Total	33.7	33.8	99.7
(ii) Male	49.0	45.1	57.6
(iii) Female	21.5	20.9	102.9

Source : Calculated from Census of India, 1981

Table II.2 : Districtwise Population and Density in Western Region, 1991

District	Total Population ('000) 1991	Rural Population as % of Total Population 1981	Density Per sq.km. =====		Per Capita Net Area Sown(ha.)
			1981	1991	
1. Agra	2705	61.4	360	672	0.12
2. Aligarh	3297	76.7	513	657	0.15
3. Bareilly	2823	71.2	552	655	0.13
4. Bijnor	2445	75.0	409	519	0.18
5. Budaun	2440	83.8	382	472	0.20
6. Bulandshahr	2842	80.4	542	655	0.14
7. Etah	2240	84.3	418	504	0.16
8. Etawah	2128	85.2	403	492	0.16
9. Farrukhabad	2431	84.3	456	567	0.14
10. Ferozabad	1532	N.A.	534	649	0.14
11. Ghaziabad	2756	65.9	711	1062	0.10
12. Haridwar	1123	N.A.	446	563	0.14
13. Meerut	3404	68.9	703	870	0.11
14. Mainpuri	1306	88.9	385	473	0.16
15. Mathura	1924	78.7	409	505	0.20
16. Moradabad	4114	73.0	528	700	0.15
17. Muzaffarnagar	2834	78.4	555	700	0.15
18. Pilibhit	1277	83.7	288	365	0.22
19. Rampur	1496	73.3	498	633	0.16
20. Saharanpur	2293	72.9	472	593	0.14
21. Shahjahanpur	1982	80.6	360	432	0.21
Western U.P.	49401	76.2	479	601	0.15
U.P.	13878	82.0	377	471	0.15

Source Census of India, 1981.

II.2 Population Density

The demographic pressure in the region is quite high (601 per sq.km.) and significantly above the state average (471 per sq.km.). At the district level population density ranges from 365 per sq. km. in Pilibhit to 1062 per sq. km. in Ghaziabad (see Table II.2 and Map II.1). The density is below 500 in 4

districts, between 500 and 750 in 14 districts and above 750 in 2 districts. Districts on the western border have in general higher density.

The degree of urbanisation is low in most of the districts. The proportion of rural population in 1981 varied from 65.9 per cent in Ghaziabad to 88.9 per cent in Mainpuri.

As a result of continuous population pressure net area sown per capita has shrunk to only 0.20 hectare. At the district level some variation in agrarian density are to be noted. Thus, net sown area per capita is below 0.12 ha. in 2 districts, between 0.12 and 0.15 ha. in 10 districts, between 0.15 and 0.18 in 5 districts and between 0.18 and 0.22 ha. in 4 districts (Table II.2 and Map II.2).

The heavy and rising biotic pressure in the region puts severe limitations on the options regarding land use planning.

II.3 Population Growth

As shown in Table II.3 the population of western region has been expanding rapidly at an accelerating rate. Between 1901-81 the population of the region has gone up by 189.7 per cent. Population growth rate in the region slightly exceeded that of the state upto 1971 on account of the lower death rates in the region. Between 1971-81, however, growth rate of population in western region (2.27 per cent) was very marginally behind that of the state as a whole (2.30 per cent), while during 1981-91 it was slightly above (2.27 per cent) the state average (2.24 per cent).

Table II.3 : Population Growth in Western Region : 1901-91

Year	Population in Million		Annual Compound Growth Rate	
	Western Region	U.P.	Western Region	U.P.
1901	17.1	48.6	-	-
1911	16.8	48.2	-0.18	-0.08
1921	15.7	46.7	-0.63	-0.34
1931	16.8	49.8	0.68	0.64
1941	19.3	56.3	1.39	1.27
1951	21.7	63.2	1.47	1.43
1961	25.7	73.8	1.69	1.56
1971	31.3	88.3	1.98	1.81
1981	37.3	110.9	2.27	2.30
1991	49.4	138.7	2.27	2.24

Source : Census Reports.

Table II.4 shows the population of different districts in the Western Region in different Census years since 1901 while Table II.5 shows per cent. growth of population at district level over different periods. Over 1901-91 the increase in population has varied between 110.0 per cent in Shahjahanpur to 372.5 per cent in Ghaziabad. Looking at population expansion during 1951-91 we find that Bijnor, Ghaziabad, Moradabad, Pilibhit and Rampur have experienced significantly higher growth (23 per cent above the state average of 116 per cent). Growth rate was moderately above the state level in Bareilly, Etawah, Farrukhabad, Meerut and Muzaffarnagar. Among the districts experiencing

Table II.4 : Districtwise Population in Western Region : 1901-81

Districts	Population in '000									
	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991
1. Agra	1057	1021	923	1047	1288	1501	1862	2307	2853	2705*
2. Aligarh	1201	1166	1062	1172	1373	1544	1765	2112	2575	3297
3. Bareilly	1070	1094	1014	1072	1176	1267	1473	1780	2273	2823
4. Bijnor	780	806	740	835	910	984	1191	1490	1939	2445*
5. Budaun	1026	1054	976	1010	1162	1251	1412	1646	1972	2440
6. Bulandshahr	1050	1037	985	1050	1217	1383	1593	1891	2358	2842
7. Etah	864	871	830	860	983	1124	1300	1571	1837	2240
8. Etawah	807	760	734	746	883	971	1182	1448	1743	2128
9. Farrukhabad	908	883	840	878	956	1093	1295	1537	1945	2431
10. Ghaziabad	582	574	568	607	717	856	1037	1341	1843	2756
11. Meerut	1029	1015	1012	1081	1280	1540	1820	2208	2767	3404
12. Mainpuri	827	798	748	750	873	994	1181	1446	1726	1306*
13. Mathura	767	660	623	672	811	712	1071	1290	1560	1924
14. Moradabad	1183	1254	1190	1274	1462	1648	1974	2429	3149	4114
15. Muzaffarnagar	876	807	794	893	1057	1222	1443	1802	2274	2834*
16. Pilibhit	470	488	432	449	491	504	616	752	1008	1277
17. Rampur	546	545	466	478	492	560	702	901	1179	1498
18. Saharanpur	1046	987	938	1045	1180	1354	1615	2055	2674	2295*
19. Shahjahanpur	939	953	856	903	983	1004	1130	1286	1648	1982
Western U.P.	17052	16783	15731	16726	19296	21716	25667	31314	39349	49401
U.P.	48628	48153	46673	49780	56335	63220	73753	88341	110862	136760

Source : Census Reports

*Figures relate to the reorganised part of the district only.

Table II.5 : Districtwise Population Growth in Western Region :
1901-81

Districts	Per cent Growth in Population During						
	1951- 61	1961- 71	1971- 81	1981- 91	1901- 51	1951- 91	1901- 91
1. Agra	24.0	24.0	23.6	19.8*	41.7	60.2	155.4
2. Aligarh	14.4	19.6	21.9	28.0	28.6	113.5	174.5
3. Bareilly	16.5	20.4	27.7	24.2	16.4	122.5	159.0
4. Bijnor	21.0	25.1	30.1	26.9*	26.2	148.5	213.5
5. Budaula	12.8	16.6	19.8	23.7	21.9	95.0	137.3
6. Bulandshahr	15.1	18.7	24.7	20.5	31.9	105.2	170.7
7. Etah	15.6	20.9	18.3	20.5	30.1	99.3	159.3
8. Etawah	21.8	22.5	20.4	20.5	20.3	119.2	163.7
9. Farrukhabad	18.5	22.2	25.2	24.7	20.4	122.4	267.7
10. Ghaziabad	21.1	29.3	37.5	49.5	47.1	222.0	373.3
11. Meerut	18.1	21.3	25.3	23.0	45.1	121.0	230.3
12. Mainpuri	18.8	22.4	19.4	23.0*	19.9	81.4	97.5
13. Mathura	17.4	20.4	20.9	23.3	18.9	111.0	150.9
14. Moradabad	19.7	23.1	29.7	30.6	39.3	149.6	247.8
15. Muzaffarnagar	18.3	24.7	26.2	26.0*	39.5	131.9	223.5
16. Pilibhit	22.2	22.1	34.1	26.7	7.2	153.4	171.7
17. Rampur	25.3	28.5	30.8	27.1	2.6	167.5	174.4
18. Saharanpur	19.3	27.2	30.1	26.2*	29.4	69.7	119.7
19. Shahjahanpur	12.5	28.1	28.1	20.3	6.9	97.4	111.0
Western U.P.	18.2	22.0	25.7	25.7	27.4	127.5	189.7
U.P.	16.7	19.8	25.5	25.2	30.0	116.3	181.2

Source : Calculated from Census Reports

*Figures relate to the reorganised part of the district only

below average growth are Agra, Aligarh, Budaun, Bulandshahr, Etan, Mainpuri, Mathura, Saharanpur and Shahjahanpur. Agra, Bareilly, Bijnor, Bulandshahr, Farrukhabad, Meerut and Shahjahanpur experienced slower growth during the decade 1981-91 over the previous decade. Rest of the districts show an acceleration in population growth during the last decade. Growth rate during 1981-91 was above 25 per cent in the districts of Aligarh, Bijnor, Chhazibad, Moradabad, Muzaffarnagar, Pilibhit, Rampur and Saharanpur.

Information on birth and death rates at district or regional level is not available. One can, however, use child-women ratio (number of children in 0-4 age group per 1000 women in 15-49 age group) as an indirect measure of fertility. This ratio turns out to be highest in the Western Region (Table II.6). The spread of family welfare programme is also very low in the region as less than 20 per cent of the couple are effectively protected so far (Table II.7). It would, therefore, be reasonable to surmise that the region, like rest of the state is in still in a high population growth stage.

Table II.6 : Regionwise Child Women Ratio in U.P.

Region	1971	1981
Western Region	734	655
Central Region	662	592
Eastern Region	634	625
Bundelkhand Region	765	634
Hill Region	622	565
Uttar Pradesh	685	627

Source : Based on Census data.

Table 11.7 : Regionwise Effectively Protected Couples in U.P., 1986

Region	Per cent of Couples Effectively Protected by			
	Sterilization	IUD	Other Methods	Total
Western Region	11.6	5.0	2.2	18.8
Central Region	12.7	5.3	2.4	20.4
Eastern Region	12.7	5.2	2.5	20.4
Bundelkhand Region	17.3	5.2	2.5	25.2
Hill Region	20.3	5.2	2.2	27.7
Uttar Pradesh	12.9	5.1	2.4	20.4

Source : State Family Welfare Bureau, U.P.

11.4 Population Projections

The preceding discussion suggests that Western Region is presently at the same stage of demographic transition as the state as a whole. Hence, in the absence of specific data for the region we may use state level figures as proxy variables for projecting population growth. As shown in Table 11.6 birth rate in U.P. has declined from 44.9 in 1974 to 37.5 in 1986, whereas death rate over the same period has declined from 20.1 to 14.6. The implied compound rates of growth come to -1.10 per cent and -2.52 per cent per annum. We have used these trend rates to project birth and death rates till 2011. These projections indicate a marginal decline in population growth rate over the period - from 3.28 per cent in 1991 to 2.23 per cent in 2000 and 2.12 per cent in 2010.

Table II.6 : Trends in Birth and Death Rates in U.P.

Year	Birth Rate	Death Rate
1971	44.9	20.1
1976	40.0	20.3
1981	39.6	16.3
1986	37.3	14.6
1991*	35.4	12.8
2001*	32.0	9.7
2011*	28.7	7.3

* Projected on the basis of past trends.

Source : Registrar General, Samole Registration Bulletin, New Delhi.

Assuming the same growth rate of population in Western U.P. and the state as a whole and using the trend in birth and death rates as observed between 1971 and 1986, we have projected the population of the region at 746.5 lakhs and that of the state at 2103.1 lakhs in 2011 (Table II.9). This implies an increase of nearly 90 per cent over 1981. Against this the medium projection of the Expert Committee indicates that U.P.'s population is likely to grow at the rate of 2.15 per cent during 1981-91 and 1.94 per cent during 1991-2001. We have extended their projections upto 2011 by assuming a growth rate of 1.50 per cent between 2001 and 2011 (Table II.9). These projections indicate U.P.'s population to register an increase of around 73 per cent between 1981 and 2011.

Table II.9 : Projected Population of Western Region and Uttar Pradesh 1981-2011

(in lakhs)

Year	Western Region		Uttar Pradesh	
	(a)	(b)	(a)	(b)
1981	393.5(100.0)	393.5(100.0)	1108.6(100.0)	1108.6(100.0)
1991	492.3(125.1)	484.4(123.1)	1386.4(125.1)	1364.7(123.1)
2001	601.9(152.9)	587.9(149.4)	1695.6(152.9)	1656.2(149.4)
2011	746.5(189.7)	681.9(173.3)	2103.1(189.7)	1921.2(173.3)

Note : (a) Our projections.

(b) Medium projections of the Expert Committee.

The proportion of urban population in Western region is assumed to have grown at the same rate as observed during 1971-81. The projected rural and urban population on this basis is indicated in Table II.10 using the medium projections of the Expert Committee.

Table II.10 : Projected Rural and Urban Population in Western Region

Year	Population in Lakhs		Per cent to Total Population	
	Rural	Urban	Rural	Urban
1971	255.9	37.2	81.7	18.3
1981	300.2	93.3	76.6	23.4
1991	345.9	138.5	71.4	28.6
2001	389.8	198.1	66.5	33.7
2011	416.6	265.3	61.1	38.9

The Expert Committee on Population Projections has projected district level population for 1991 by allocating the expected increase in State population over the preceding period in the same

Table II.11 : Districtwise Projected Population of Western Region

Districts	Projected Population in '000			Per cent Change in 1991-2011
	1991	2001	2011	
1. Agra	3471	4171	4807	38.5
2. Aligarh	3101	3713	4269	37.7
3. Bareilly	2834	3475	4056	43.2
4. Bijnor	2450	3033	3563	45.4
5. Budaun	2342	2750	3121	33.3
6. Bulandshahr	2889	3501	4037	40.4
7. Etah	2185	2564	2909	33.1
8. Etawah	2078	2457	2802	34.8
9. Farrukhabad	2395	2890	3340	37.5
10. Ghaziload	2414	3055	3636	50.7
11. Meerut	3403	4132	4795	40.9
12. Mainpuri	2045	2395	2713	32.7
13. Mathura	1867	2217	2535	35.8
14. Moredabad	2968	4901	5745	44.9
15. Muzaffarnagar	2811	3224	3599	28.0
16. Pilibhit	1299	1520	1912	47.2
17. Rampur	1494	1844	2162	44.7
18. Saharanpur	3377	4164	4879	44.5
19. Shahjahanpur	2059	2523	2949	43.2
Western U.P.	48452	58631	67857	40.0
U.P.	136472	165624	192124	40.8

proportion as the share of each district in the observed increase in the state population in the earlier period. Using the medium state level population projection of the Expert Committee and applying the same formula we have worked out the projected population at the district level for the year 2001 and 2011 (Table II.11).

II.5 Work Force and Structure

The work force in the Western Region shows a growth of 16.3 per cent during 1961-71 which jumps to 23.1 per cent in 1971-81, while the corresponding increase was only 11.1 per cent and 16.5 per cent in U.P. (Table II.12). We also find that the growth of agricultural workers in the region, which was very high during 1961-71 dropped markedly during 1971-81. During the latter decade the growth of non-agricultural workers has been relatively faster. As a result the proportion of agricultural workers shows a small decline between 1971 and 1981. However, nearly 70 per cent of work force in the region is still engaged in agriculture, though the region is somewhat more diversified than the state as a whole (Table II.12). The structure of work force at the district level has been shown in Table II.13.

The rapid growth of agricultural workers has further worsened the adverse land-worker ratio in the region and added to the growth of marginal and small holdings, which now constitute nearly 82 per cent of total holdings in the region and account for 42 per cent of area. Average size of holding has shrunk to only 1.22 hectare.

Table II.12 : Growth and Structure of Work Force in Western Region

Item and Period	Western Region	Uttar Pradesh
A. No. of Total Workers in '000		
1961 (Adjusted)	7737	24600
1971	9000	27334
1981 (Main)	11083	32397
B. No. of Agricultural Workers in '000		
1961 (Adjusted)	4658	17442
1971	6406	21132
1981 (Main)	7664	24133
C. Agricultural Workers As Per cent of Total Workers		
1961 (Adjusted)	60.2	70.9
1971	71.2	77.4
1981 (Main)	69.1	74.3
D. Growth of Total Workers in Per cent		
1961-71	16.3	11.1
1971-81	23.1	13.5
E. Growth of Agricultural Workers in Per cent		
1961-71	37.5	21.2
1971-81	19.6	14.1

Source : Calculated from Census Reports.

Table II.13 : Districtwise Total Workers and Structure of Work Force, 1981

Districts	Total Workers ('000)	Agricultural Workers ('000)	Agricultural Workers as Per cent to Total Population
1. Agra	783	321	48.7
2. Aligarh	683	459	67.2
3. Bareilly	656	463	70.6
4. Bijnor	539	356	65.9
5. Budaun	617	533	86.4
6. Bulandshahr	610	427	70.0
7. Etan	524	430	82.1
8. Etawah	457	360	78.6
9. Farrukhabad	562	440	78.3
10. Ghaziabad	506	229	45.3
11. Meerut	766	427	55.8
12. Mainpuri	468	381	81.4
13. Mathura	429	288	67.1
14. Moradabad	895	624	69.7
15. Muzaffarnagar	648	455	70.2
16. Pilibhit	301	244	81.1
17. Rampur	347	256	74.4
18. Saharanpur	781	496	63.5
19. Shahjahanpur	510	413	80.8
Western U.P.	11083	7664	69.1
U.P.	32397	24135	74.5

Source : Census of India, 1981.

II.6 Trends in Output and Income

No series of income at district and regional level is available. However, the State Planning Institute is bringing out a series of net output of commodity producing sectors at the district level. We may, therefore, look at the economic trends in the region with the help of whatever diverse information is available. According to a study by A.K. Singh net regional output in West U.P. increased at a rate of 3.07 per cent and per capita output at a rate of 1.25 per cent in real terms over the period 1951-71.¹ According to a study by R.C. Sinha the rate of growth of regional income recorded by Western Region between 1968-76 was 4.82 per cent against state level growth of 3.69 per cent, while growth rate of per capita income was 3.69 per cent and 1.59 per cent respectively.²

The primary sector contributed 35.45 per cent of regional income in Western Region in 1975-76 as compared to the figure of 58.53 per cent at the state level (Table II.14). The share of secondary sector was relatively more in Western Region (19.19 per cent) as compared to the state (15.98 per cent), while that of tertiary sector was roughly of the same order (around 25 per cent). Between 1968-69 and 1975-76 the secondary sector gained at the cost of the other two sectors.

-
1. Ajit Kumar Singh, Patterns of Regional Development : A Comparative Study, Sterling Publishers, New Delhi, 1981.
 2. R.C. Sinha, Inter-Regional and Inter-District Variations in Levels and Growth of Income in Uttar Pradesh 1968-69 to 1976-77, Giri Institute of Development Studies, Lucknow, 1983 (Mimeo.)

Table II.14 : Sectoral Shares in Regional Incomes (Per cent)

Sector	Western Region		Uttar Pradesh	
	1968-69	1975-76	1968-69	1975-76
Primary Sector	56.48	55.45	59.67	58.53
Secondary Sector	16.32	19.19	14.10	15.98
Tertiary Sector	27.20	25.36	26.23	25.49
All Sectors	100.00	100.00	100.00	100.00

Source : R.C. Sinha, op. cit.

For the study of economic trends in the latter period we have to rely on the study of trends in the output of the commodity producing sectors only. However, as these sectors contribute about three-fourth of the regional income, these trends can be regarded as representing the trends in overall income. During the period 1971-72 and 1985-86 the output of agriculture and allied sectors increased at a rate of 2.7 per cent per year and that of manufacturing sector at a rate of 7.8 per cent in Western Region (Table II.15). The annual growth rates of total and per capita income from commodity producing sectors were 3.5 and 3.1 respectively. We also observe that the growth rates are distinctly higher in the Western Region as compared to the state as a whole.

Table II.15 : Sectorwise Growth Rates in Western Region 1971-72 to 1985-86

(Per cent per annum)

Sectors	Western Region	Uttar Pradesh
1. Agriculture and Allied Sectors	2.7	2.5
2. Manufacturing Sector	7.8	7.2
3. Total Income	5.5	5.2
4. Per Capita Income	3.1	0.9

Source : Government of Uttar Pradesh, Planning Department, Draft Annual Plan 1989-90, Vol.I, p.32.

Table II.16 show the districtwise per capita output of commodity producing sector and its composition in 1985-86. One would note that there are significant variations in the level and structure of per capita output in the region.

II.7 Income Projections

To work out projections of per capita income we have rounded the reported per capita income of Rs.1991 in 1985-86 to Rs.2000 and taken the per capita income of Western Region at Rs.1500, i.e. 25 per cent above the state average on the basis of the differentials reported in earlier studies. The study of recent trends of income suggests that it would be reasonable to assume an annual growth rate of per capita income at 2.5 per cent at the state level and 3.0 per cent in Western Region. Using these assumptions we have worked out the projected per capita income of the region till 2011 shown in Table II.16. Thus per capita income

Table II.16 : Districtwise Level and Structure of Per Capita Output, 1985-86

Districts	Per Capita Output (Rs.)	(Per cent share in total output)		
		Agriculture and Animal Husbandry	Forestry and Logging	Manufacturing Registered and Unregistered
1. Agra	999	61.6	0.5	35.9
2. Aligarh	1249	72.9	0.0	26.6
3. Bareilly	1087	69.6	0.0	29.6
4. Bijnor	1642	72.6	3.4	22.8
5. Budaut	1109	91.8	0.1	7.9
6. Bulandshahr	1350	79.2	0.3	20.3
7. Etan	1183	80.9	0.0	16.3
8. Etawan	992	80.3	0.4	19.0
9. Farrukhabad	1286	86.6	0.0	13.1
10. Ghaziabad	1962	86.7	0.4	12.6
11. Meerut	1556	45.9	0.1	53.7
12. Mainpuri	1015	65.0	0.1	34.8
13. Mathura	1834	33.7	0.0	65.8
14. Moradabad	1115	78.0	0.2	21.6
15. Muzaffarnagar	1732	82.9	0.0	16.4
16. Pilibhit	1227	83.7	4.0	12.1
17. Rampur	790	59.9	1.9	39.0
18. Saharanpur	1868	52.9	0.6	46.0
19. Shahjahanpur	987	89.5	0.2	9.8
Western U.P.	1324	69.8	0.5	29.8
U.P.	1070	71.8	1.1	25.5

Source : Draft Annual Plan 1989-90, Vol.I, Uttar Pradesh, p.28.

Table II.17 : Projected Per Capita Income of Western Region

(Rs.)

Year	Western Region	Uttar Pradesh
1985-86	2500 (100.0)	2000 (100.0)
1990-91	2705 (116.2)	2256 (112.8)
1995-96	3376 (135.0)	2567 (128.4)
2000-01	3922 (156.9)	2909 (145.5)
2005-06	4557 (182.3)	3296 (164.8)
2010-11	5296 (211.8)	3734 (186.7)

Note : (1). Projections are made by assuming a compound annual growth rate of per capita income at 3.0 per cent in Western Region and 2.5 per cent in U.P.

(2). Figures in parentheses show index.

is expected to roughly increase by 110 per cent in Western Region and by 90 per cent in Uttar Pradesh between 1985-86 and 2010-11. As population is projected to increase by around 60 per cent over this period on medium assumptions, the increase in total income is expected to be about 170 per cent in case of Western Region and 150 per cent in case of Uttar Pradesh. The implied growth rate of total income comes to 4.83 per cent and 4.33 per cent respectively. These appear to us medium range and realisable projections.

CHAPTER III

DEMAND PROJECTIONS

III.1 Methodology

An idea of the likely demand for different agricultural commodities would be helpful in devising an optimum land use plan and in setting production targets for the region under study. Western Region of U.P., placed as it is in a favourable environment for agricultural development, can contribute substantially to the national kitty of foodgrains. From this view point also an estimate of the likely level of demand and surplus in the region would be useful. The demand projections attempted here are to be seen as broadly indicative of the future requirements and the efforts required in meeting them.

The State Planning Institute, U.P. Government has conducted a detailed study of the household consumption in U.P. at the regional and district level which refers to the year 1969-70.¹ In the absence of consumption data for a more recent period we have taken per capita household consumption for 1969-70 in rural and urban areas of Western U.P. as reported in the study as representing the base year per capita demand for agricultural commodities. It has been assumed that per capita consumption expenditure will increase at the rate of 2 per cent per annum in

-
1. Perspective Planning Division, State Planning Institute, Planning Department, U.P. Government, Household Consumption and Demand Analysis For Uttar Pradesh, Lucknow, 1977-78 (mimeo.)

the rural areas and 3 per cent per annum in the urban areas. For purposes of projecting per capita demand we have used the expenditure elasticity of demand for various commodities in rural and urban areas separately computed by us from the N.S.S. consumer expenditure data for U.P. for the year 1977-78.¹

Per capita base year consumption in rural and urban areas has then been projected for the years 1990-91, 2000-01 and 2010-11 on the basis of the expected increase in consumption levels as assumed above and the computed elasticities of demand. To arrive at the aggregate demand we have multiplied the projected per capita demand in rural and urban areas by the projected rural and urban population in the region using the medium projections of the Expert Committee. To the projected aggregate demand an amount of 20 per cent is added on account of demand for seed, feed, wastage, industrial demand, etc. in case of foodgrains.

III.2 Alternative Demand Projections

Per capita base year consumption as well as projected per capita demand for different commodities for the years 1990-91, 2000-01 and 2010-11 have been shown in Table III.1. The corresponding projected aggregate demand for different years has been shown in Table III.2. It will be observed that the demand for agricultural commodities over the period 1991-2011 is likely

1. For details see Ajit Kumar Singh, Perspective Plan For the Conservation, Management and Development of Land Resources For The Central Zone, Giri Institute of Development Studies, Lucknow, 1991 (Mimeo.)

Table III.1 : Per Capita Projected Demand in Rural & Urban Areas in West U.P.

(Kg. per year)

Commodity	Rural				Urban			
	1969-70*	1990-91	2000-01	2010-11	1969-70*	1990-91	2000-01	2010-11
1. Rice	28.3	40.3	47.6	56.2	17.8	30.2	38.7	49.3
2. Wheat	98.3	135.9	158.4	184.7	111.5	176.8	257.4	336.7
3. Jowar	5.0	5.6	5.9	6.2	0.6	0.7	7.7	8.4
4. Bajra	26.4	33.2	35.9	46.0	0.6	0.7	7.4	7.6
5. Maize	32.9	41.6	46.3	51.5	5.6	7.8	9.1	10.6
6. Barley	1.4	1.7	1.9	2.1	4.7	5.5	5.9	6.3
7. Small Millets	25.4	29.2	31.0	33.0	16.7	28.3	36.1	46.1
8. <u>Cereals</u>	<u>217.7</u>	<u>301.0</u>	<u>350.7</u>	<u>408.5</u>	<u>157.5</u>	<u>287.7</u>	<u>383.4</u>	<u>511.0</u>
9. Gram	0.8	1.1	1.3	1.5	6.5	11.3	14.7	19.0
10. Other pulses	17.2	23.2	26.8	30.9	15.4	27.7	36.0	46.7
11. <u>Pulses</u>	<u>18.0</u>	<u>24.2</u>	<u>28.1</u>	<u>32.4</u>	<u>21.9</u>	<u>39.0</u>	<u>50.7</u>	<u>65.7</u>
12. <u>Total Foodgrains</u>	<u>235.7</u>	<u>344.7</u>	<u>417.1</u>	<u>504.7</u>	<u>179.4</u>	<u>332.4</u>	<u>445.8</u>	<u>597.9</u>
13. Milk	36.3	63.1	83.3	109.9	40.2	99.0	139.2	193.7
14. Edible Oils	2.9	4.3	5.2	6.2	2.8	5.2	7.0	9.4
15. Vegetables	49.7	65.6	78.9	94.8	77.2	138.3	182.3	240.5
16. Ghee	1.8	2.7	3.3	4.0	2.1	3.9	5.2	7.0
17. Sugar & Khandsari	3.4	5.1	6.2	7.6	10.1	18.2	24.1	31.8
18. Vanaspathi	0.9	1.4	1.7	2.1	2.9	5.4	7.3	9.7

* Actual

Table III.2 : Projected Demand For Agricultural Commodities For Western U.P.

Commodity	Projected Demand in Lakh Tonnes			Per cent Increase	
	1990-91	2000-01	2010-11	2000-01 over 1990-91	2010-11 over 1990-91
1. Rice	21.7	31.6	43.8	45.6	101.8
2. Wheat	61.4	135.2	199.6	120.2	225.1
3. Jowar	2.4	4.6	5.6	91.7	141.7
4. Bajra	13.9	19.1	23.0	37.4	65.5
5. Maize	18.6	23.9	29.2	28.5	57.0
6. Barley	1.7	2.3	3.1	35.3	82.4
7. Other Cereals	16.8	23.2	31.2	38.1	85.7
8. <u>Total Cereals</u>	<u>172.8</u>	<u>355.2</u>	<u>367.0</u>	<u>47.7</u>	<u>112.4</u>
9. Gram	2.4	4.1	6.7	70.8	179.2
10. Other pulses	14.4	21.1	30.2	46.5	109.7
11. <u>Total Pulses</u>	<u>16.8</u>	<u>25.2</u>	<u>37.1</u>	<u>50.0</u>	<u>120.8</u>
12. <u>Total Foodgrains</u>	<u>198.2</u>	<u>301.1</u>	<u>442.7</u>	<u>51.9</u>	<u>123.4</u>
13. Milk	42.6	72.1	117.2	69.2	175.1
14. Ghee	1.7	2.7	4.3	58.8	152.9
15. Edible Oils	2.6	4.1	6.1	57.7	134.6
16. Vanaspathi	1.6	2.6	4.2	62.5	162.5
17. Sugar & Khandsari	5.2	8.6	13.9	65.4	167.3
18. Vegetables	50.3	80.3	124.0	59.6	146.5

Note : Projections of total cereals and total foodgrains have been derived independently and hence do not correspond to the total of different crops.

to go up very sharply in the region. Thus foodgrains demand is likely to increase by 123.4 per cent or at a compound growth rate of 4 per cent per year. Even sharper increases in demand are expected to take place in the case of non-foodgrain items like milk, sugar, vegetables, etc.

Table III.3 : Projected Demand For Agricultural Commodities in West U.P. on The Basis of Base Year Consumption

(Lakh tonnes)

Commodity	1990-91	2000-01	2010-11
1. Rice	14.8	17.5	19.7
2. Wheat	59.3	72.1	84.4
3. Jowar	2.2	2.4	2.6
4. Bajra	11.0	12.4	13.3
5. Maize	14.6	16.7	18.2
6. Barley	1.4	1.9	2.4
7. Other Cereals	13.3	15.8	18.0
8. Total Cereals	116.5	138.6	158.4
9. Gram	1.4	2.0	2.3
10. Other Pulses	9.6	11.5	13.3
11. Total Pulses	11.0	13.5	15.6
12. Total Foodgrains	127.5	152.2	174.2
13. Milk	21.8	26.5	31.0
14. Edible Oil	1.6	1.8	2.0
15. Vegetables	31.4	39.2	46.9
16. Ghee	1.1	1.3	1.6
17. Sugar/Khandsari	3.1	4.0	4.9
18. Vanaspati	0.8	1.1	1.4

It needs to be stressed that the implied levels of per capita level of foodgrains used for projections above are substantially above the normal physical requirements. Hence these may be taken as representing high projections. We have, therefore, worked out alternative projections using the base year consumption levels, which again are above the recommended nutritional requirement. The alternative projections have been arrived at by adding up the projected rural and urban demand and adding up 20 per cent on account of other types of demand in case of foodgrains. The second set of projected demand, which may be called medium projections, has been shown in Table III.3. According to the medium projections the demand for foodgrains is likely to increase from 127.5 lakh tonnes in 1990-91 to 152.2 lakh tonnes in 2001 and to 174.2 lakh tonnes in 2011.

III.3 Normative Requirements

We have also projected the requirements of agricultural commodities on the basis of dietary norms recommended by the Indian Council of Medical Research and the projected population using the medium population projections of the Expert Committee. These are shown in Table III.4. The projections on the basis of the normative requirement are substantially below the high projections worked out by us and even below the medium projections. These may, therefore, be called the low projections. According to these projections the demand for foodgrains in Western U.P. is likely to go up from 104.1 lakh tonnes in 1991 to 127.4 lakh tonnes in 2001 and further to 157.0 lakh tonnes in 2011.

Table III.4 : Normative Requirements of Agricultural Commodities in West U.P.

(Lakh tonnes)

Commodity	Per Capita Normative Requirement (Kg./year)	Aggregate Requirement		
		1990-91	2000-01	2010-11
1. Cereals	159.1	94.0	115.0	141.6
2. Pulses	17.1	10.1	12.4	15.4
3. Foodgrains	176.2	104.1	127.4	157.0
4. Vegetables	41.3	24.4	29.9	37.0
5. Tubers	16.1	9.5	11.6	14.4
6. Milk	80.3	47.4	58.0	71.9
7. Fats & Oil	12.4	7.3	9.0	11.2
8. Sugar/Jaggery	12.4	7.3	9.0	11.2

Table III.5 indicates the projected level of demand for foodgrains in Western region of U.P. as per cent of the current level of demand. The required rate of increase in output over the period 1986 to 2011 comes to 31.7 per cent, 46.1 per cent and 271.3 per cent according to our low, medium and high projections. Considering the favourable agricultural situation in the region the target of foodgrains production in Western Region may be kept between 250 to 300 lakh tonnes, i.e., an increase of about two to two and a half times over the current level of output.

Table III.5 : Alternative Projections For Foodgrains Production in West U.P. for 1991, 2001 and 2011

(Lakh tonnes)

Year	High Projections	Medium Projections	Low Projections
1. Current Foodgrains Output (Average 1983-84 to 1985-86)	119.2	119.2	119.2
2. Projected Demand in			
1990-91	198.2	127.5	104.1
2000-01	301.1	152.2	127.4
2010-11	442.7	174.2	157.0
3. Projected Demand As Per cent of Current Output in			
1990-91	166.2	106.9	87.3
2000-01	252.6	127.7	106.9
2010-11	371.3	146.1	131.7

III.4 District Level Projections

District level projected foodgrains requirements have been worked out on the basis of normative requirements. It will be seen from Table III.4 and Maps III.1 and III.2 that a majority of districts is surplus in terms of foodgrain output on the basis of normative requirements. But 7 districts of the region are deficit districts, most of which fall in the sugarcane belt in the north-western part of the region. The supply of foodgrains is, however, adequate in terms of nutritional requirements for the region as a whole.

Table III.6 : Districtwise Normative Requirements of Foodgrains In West U.P.

(in '000 tonnes)

District	Projected Normative Requirement			Current Foodgrains Output (Average 1983-86)	Projected Requirement As Percent of Current Output		
	1991	2001	2011		1991	2001	2011
1. Agra	734	882	1016	560	131	158	181
2. Aligarh	656	785	903	915	72	86	99
3. Bareilly	599	734	858	395	101	123	144
4. Bijnor	518	641	753	420	123	153	179
5. Budaun	495	582	660	693	71	84	95
6. Bulandshahr	611	740	858	954	64	78	90
7. Etah	462	542	615	611	76	89	101
8. Etawah	439	520	592	566	78	92	105
9. Farrukhabad	506	611	706	576	88	106	123
10. Ghaziabad	510	646	769	399	128	162	193
11. Meerut	720	874	1014	558	129	157	182
12. Mainpuri	432	506	574	392	73	85	97
13. Mathura	395	469	536	582	68	81	92
14. Moradabad	839	1030	1216	852	93	122	143
15. Muzaffarnagar	594	724	761	553	107	131	138
16. Pilibhit	275	342	404	555	49	62	73
17. Rampur	316	390	457	483	65	81	95
18. Saharanpur	714	880	1032	699	126	127	148
19. Shahjahanpur	435	534	624	759	57	70	82
Total West U.P.	10410	12740	15700	11922	87	107	132

CHAPTER IV

OUTPUT AND YIELD TRENDS AND SUPPLY POSSIBILITIES

IV.1 Trends in Output

We now propose to discuss the supply trends and possibilities in the region under study. Discussion of district level trends is confined to foodgrains only due to consideration of space. For purposes of our analysis supply is treated as equivalent to output in the region. We have examined the trends in the output of major crops and crop groups in the post green revolution period since the recent trends are more relevant for the purposes of projections. To eliminate the impact of annual fluctuations we have taken three yearly average of output centred around 1969-70 and 1984-85. Annual compound growth rates in output are then computed over the study period to get an idea of the trend rates of growth over the period.

With a share of about 35 per cent in the net cultivated area in the state Western U.P. accounts for 39.2 per cent of foodgrains output in the state. Its major specialisation is in wheat, bajra, maize, barley, oilseeds, sugarcane and potato, where it accounts for a substantially higher proportion of state output than its share in cropped area (Table IV.1). On the other hand, its share in the output of pulses, rice and jowar is much less.

Yearwise trends in output of major crops in the Western Region since 1968-69 have been given in Appendix IV.1, while compound growth rates over the period 1968-71 to 1983-86 have been

Table IV.1 : Share of Western U.P. in the Output of Major Crops in Uttar Pradesh

Crops	Per cent Share of West U.P. in State Output		
	1968-71	1983-86	Change in % Point
Rice	23.6	26.8	+ 3.2
Wheat	51.0	45.7	- 5.3
Jowar	15.2	15.7	+ 0.5
Bajra	69.9	73.5	+ 3.6
Maize	53.5	61.6	+ 8.1
Barley	19.9	46.3	+26.4
<u>Total Cereals</u>	41.0	41.1	+ 0.1
Gram	28.8	16.8	-12.0
Arhar	26.1	19.5	- 6.6
<u>Total Pulses</u>	28.9	22.4	- 6.5
<u>Total Kharif Foodgrains</u>	33.1	33.7	+ 0.6
<u>Total Rabi Foodgrains</u>	41.6	42.5	+ 0.9
<u>Total Foodgrains</u>	38.6	39.5	+ 0.9
<u>Total Oilseeds</u>	43.2	56.9	+13.7
Ground Nut	49.0	43.5	- 5.5
Rapeseed & Mustard	40.0	69.7	+29.7
Sugarcane	60.0	69.0	+ 9.0
Potato	40.4	55.4	+15.0

Source : Calculated from Agricultural Statistics of U.P. (Annual)

shown in Table IV.2. The region has recorded an impressive growth rate of 4.55 per cent per annum in case of cereals and 3.60 per

Table IV.2 : Trends in Output of Major Crops in West U.P.
1968-69 to 1985-86

Crops	Output in Lakh Tonnes		Index	Compound Growth Rate (Per cent Per Annum)	
	1968-71	1983-86		West U.P.	U.P.
Rice	7.6	19.9	261	6.61	5.71
Wheat	34.3	73.6	214	5.20	5.98
Jowar	0.7	0.8	121	1.25	0.70
Bajra	5.1	6.1	121	1.28	0.80
Maize	7.6	9.0	119	1.17	0.20
Barley	2.7	3.8	143	2.41	-2.27
<u>Total Cereals</u>	58.1	113.2	195	4.55	4.52
Gram	4.7	2.1	45	-2.96	-1.39
Arhar	1.3	1.5	82	-1.11	0.70
<u>Total Pulses</u>	10.0	6.0	60	-2.27	-1.39
<u>Total Kharif Foodgrains</u>	21.1	35.8	170	3.60	3.44
<u>Total Rabi Foodgrains</u>	46.9	82.8	176	3.64	3.72
<u>Total Foodgrains</u>	68.1	119.2	175	3.60	3.64
<u>Total Oilseeds (Pure)</u>	1.6	2.9	175	3.60	2.12
Ground Nut	1.2	0.5	43	-3.53	-5.33
Rapeseed & Mustard	0.4	2.3	326	13.61	9.55
Sugarcane	331.7	544.2	154	3.38	2.28
Potato	6.3	27.6	437	12.01	9.36

Source : Calculated from Agricultural Statistics of U.P. (Annual)

cent in case of total foodgrains. Pulse output has, however, registered a decline in the region. Among cereals growth rates of wheat and rice output were quite high, but those of coarse cereals were rather low. The performance of the region with respect to the commercial crops has also been quite encouraging except in the case of groundnut, which registered a decline in output. On the whole the growth rate of agricultural output in the western region has been considerably higher than that of population. The growth performance of agriculture in West U.P. in the post green revolution period has been only marginally better than that of the state as a whole as far as foodgrains output is concerned, but it has been distinctly better in case of commercial crops.

As shown in Table IV.3 the growth of foodgrains output has varied from 2.07 per cent to 6.79 per cent per annum. The rate of growth was below 3 per cent per annum in 6 districts, between 3 and 5 per cent in 10 districts and above 5 per cent in 3 districts. In general the districts on the South-west part of the region, where irrigation facilities are lower, have recorded lower rate of output growth.

IV.2 Trends In Average Yields

Yearwise average yield of major crops in the region since 1968-69 have been shown in Appendix IV.2, while growth rates of average yield over the period 1968-71 and 1983-86 have been shown in Table IV.4. Most of the cereal crops have registered fairly high increases in average yields in the region over the period. Rice and Jowar yields have nearly doubled, while wheat yield has

Table IV.3 : Districtwise Trends in Foodgrains Output in Western Uttar Pradesh (1968-69 to 1985-86)

Sl. District No.	Output in '000 Tonnes		Per cent Increase	Annual Compound Growth Rate (%)
	Average for 1968-71 1983-86			
1. Agra	389	560	44	2.46
2. Aligarh	673	915	36	2.07
3. Bareilly	280	595	12	5.14
4. Bijnor	250	420	68	3.52
5. Budaun	363	693	91	4.41
6. Bulandshahr	569	934	66	3.52
7. Etah	438	611	39	2.22
8. Etawah	397	566	43	2.41
9. Farrukhabad	325	576	78	3.92
10. Ghaziabad	209	399	91	4.41
11. Meerut	316	558	76	3.84
12. Mainpuri	390	592	52	2.83
13. Mathura	382	532	52	2.83
14. Moradabad	457	852	87	4.26
15. Muzaffarnagar	304	553	82	4.07
16. Pilibhit	200	533	166	6.74
17. Rampur	237	483	103	4.84
18. Saharanpur	347	699	101	4.77
19. Shahjahanpur	283	759	168	6.79
Western U.P.	6808	11922	75	3.80
Uttar Pradesh	17640	30981	74	3.64

Source : Calculated from Agricultural Statistics of U.P. (Annual)

gone up by 61 per cent. Pulse yields, however, reveal near stagnation. In case of commercial crops only potato yield shows sharp jump, but the gains in oilseeds and sugarcane have been moderate. Thus, the technological breakthrough is largely confined to the cereal crops particularly rice and wheat. The pattern of growth in yield rates has been more or less similar in

Table IV.4 : Trends in Average Yield of Major Crops in West U.P.
1968-69 to 1985-86

Crops	Average Yield (Qtl./Ha.)		Index	Compound Growth Rate (Per cent per Annum)	
	1968-71	1983-86		West U.P.	U.P.
Rice	8.53	17.46	205	4.94	4.07
Wheat	14.27	22.99	161	3.23	3.01
Jowar	3.93	7.90	198	4.66	4.87
Bajra	6.75	8.68	129	1.74	1.61
Maize	10.91	14.95	137	2.12	1.76
Barley	10.80	17.51	162	3.27	2.56
<u>Total Cereals</u>	11.23	18.97	169	3.56	3.44
Gram	8.30	9.81	118	1.11	1.05
Arhar	12.64	14.96	118	1.11	1.53
<u>Total Pulses</u>	9.00	9.19	102	0.13	0.34
<u>Total Kharif Foodgrains</u>	8.23	13.82	163	3.52	3.23
<u>Total Rabi Foodgrains</u>	12.61	21.19	168	3.52	3.14
<u>Total Foodgrains</u>	10.83	18.02	166	3.44	3.27
<u>Total Oilseeds (Pure)</u>	6.27	7.12	114	0.88	0.51
Ground Nut	6.38	6.77	106	0.39	-0.64
Rapeseed & Mustard	6.33	7.62	120	1.22	1.06
Sugarcane	436.56	499.10	144	0.88	0.70
Potato	91.08	184.81	203	4.84	3.56

Source : Calculated from Agricultural Statistics of U.P. (Annual)

the state as a whole, though the Western region has kept an edge in case of most of the crops over the state.

As shown in Table IV.5 considerable variations in the yield levels exist at the district level. Thus rice yields vary from 954 Kg. per ha. to 2239 Kg. per ha., wheat yields from 1770 Kg. per ha. to 2771 Kg. per ha. and sugarcane yield from 523 qtls. per ha. to 582 qtls. per ha. Foodgrain yields per ha. are below 1.6 tonnes in 4 districts, between 1.6 and 2.0 tonnes in 9 districts and above 2.0 tonnes in 6 districts. Highest productivity is found to occur in the north western part of the region covering the districts of Saharanpur, Muzaffarnagar, Ghaziabad, Meerut and Bulandshahr. A low productivity tract consists of the districts of Bareilly, Budaun and Etah (Map IV.1).

Similarly value productivity shows a wide variation from Rs.1041 at constant prices of 1971-72 to Rs.2520 per ha. (Map IV.2). In general value productivity is lower in the drier southern part of the region as compared to the northern part.

Growth rates of foodgrain yields between 1965-71 and 1983-86 have varied from 1.76 per cent per annum to 4.97 per cent (Table IV.6). In general foodgrain yields show fairly high rates of growth with as many as 15 districts registering growth rates of over 3 per cent per annum. Thus the forces of technological revolution in agriculture have been geographically widespread through most parts of the region and the state.

Table IV.5 : Average Yield of Major Crops in Western Uttar Pradesh (Average for 1985-86)

Sl. District No.	Average Yield Per Hectare			
	Rice (Kg.)	Wheat (Kg.)	Total Food- grains (Kg.)	Sugarcane (t/ha.)
1. Agra	1185	2501	1643	375
2. Aligarh	1255	2515	1734	450
3. Bareilly	1682	1770	1555	402
4. Bijnor	1823	1884	1768	504
5. Budaun	1212	2043	1472	467
6. Bulandshahr	954	2735	2224	461
7. Etan	1062	2067	1507	402
8. Etawah	1421	2344	1575	366
9. Farrukhabad	1405	2433	1801	431
10. Ghaziabad	1473	2672	2104	500
11. Meerut	1706	2757	2375	512
12. Mainpuri	1297	2138	1604	375
13. Mathura	1194	2517	1811	323
14. Moradabad	1705	2066	1733	476
15. Muzaffarnagar	2239	2631	2353	582
16. Pilibhit	2035	1935	1888	437
17. Rampur	2137	2354	2024	449
18. Saharanpur	2146	2771	2064	506
19. Shahjahanpur	1735	2167	1751	472
Western U.P.	1746	2299	1802	499
Uttar Pradesh	1353	1921	1464	471

Source : Calculated from Agricultural Statistics of U.P. (Annual)

Table IV.6 : Growth Rates of Foodgrain Yield : Western U.P.
(1958-86)

Sl. District	Average Yield (Qtl./Ha.)		Index	Compound Growth Rate (Per cent Per Annum)
	1962-71	1983-86		
1. Agra	10.33	16.43	159	3.14
2. Aligarh	13.29	17.34	130	1.76
3. Bareilly	8.41	15.55	185	4.19
4. Bijnor	9.35	17.68	189	4.34
5. Budaun	8.75	14.72	168	3.52
6. Bulandshahr	12.79	22.24	174	3.76
7. Etah	11.52	15.07	131	1.82
8. Etawah	11.56	15.75	136	2.07
9. Farrukhabad	10.50	18.01	192	3.68
10. Gaziabad	11.41	21.04	184	4.15
11. Meerut	14.39	23.95	166	3.44
12. Mainpuri	11.15	16.04	144	2.46
13. Mathura	11.50	18.11	157	3.05
14. Moradabad	9.67	17.32	179	3.96
15. Muzaffarnagar	12.49	23.53	188	4.30
16. Pilibhit	9.24	18.88	204	4.87
17. Rampur	10.77	20.24	188	4.30
18. Saharanpur	10.31	20.64	200	4.73
19. Shahjahanpur	8.46	17.51	207	4.97
Western U.P.	10.83	18.02	166	3.44
Uttar Pradesh	9.05	14.64	162	3.27

Source : Calculated from Agricultural Statistics of U.P. (Annual)

IV.3 Projected Demand and Supply

The projected requirements of different agricultural commodities worked out in Chapter III have been compared with the projected supply in the years 1991 and 2011 in Table IV.7. Supply projections have been worked out on the assumption that the growth

Table IV.7 : Projected Demand and Supply of Agricultural Commodities in West U.P.

(Lakh Tonnes)

Commodity	Projected Demand		Projected Supply		Projected Supply As a % of Projected Demand	
	2001	2011	2001	2011	2001	2011
Rice	31.6	45.8	55.3	109.3	175	230
Wheat	135.2	199.6	163.6	289.3	122	145
Jowar	4.6	5.8	0.1	0.1	2	2
Bajra	19.1	23.0	7.4	8.5	39	37
Maize	23.9	29.2	10.9	12.2	46	42
Barley	2.3	3.1	5.6	7.1	243	229
Total Cereals	255.2	367.0	230.9	360.0	90	98
Total Pulses	25.2	37.1	8.4	11.0	33	30
Total Pseudocereals	301.1	442.7	216.9	314.7	72	71
Total Oilseeds	12.3	18.6	3.3	7.7	42	41
Sugarcane	32.0	86.0	869.0	1216.7	1671	1415

Note : Demand for edible oils is expressed in terms of oilseeds using a conversion ratio of 33 per cent, while the demand for sugar and khandsari is expressed in terms of sugarcane using a conversion ratio of 10 per cent.

rates in output observed for the period 1968-71 to 1983-86 will be maintained in future also.

The region is likely to remain a surplus region in case of rice, wheat and sugarcane but there will be large deficits as far as coarse cereals, pulses and oilseeds are concerned. Though the region has experienced a fairly high growth rate of 3.8 per cent

in the post-green revolution period, the demand for foodgrains is projected to increase at nearly 4 per cent per year. Hence it would be imperative that all efforts are made to maintain the tempo of agricultural growth in the region.

IV.4 Supply Possibilities

Western Region of Uttar Pradesh is among the better developed agricultural region of the country with good irrigation facilities and high degree of mechanization. However, a look at the comparative yields of different crops reveals that there is a considerably technological lag to be covered. Thus, the yield of wheat in the region is still 2.3 tonnes per ha., against 3.3 tonnes in Punjab (Table IV.8). The gap in the case of rice yields is even larger. In oilseeds and sugarcane also yield levels are relatively low. The technological lag is also reflected in terms of indicators of modernization of agriculture in the region like irrigation facilities, fertiliser consumption, mechanization, etc. (Table IV.9)

It would thus appear that there are good possibilities of raising agricultural output in the region through a more widespread and intensive use of the modern technological packages and expansion of irrigation facilities. The major constraint on agricultural development in future in the region is the high proportion of small and marginal holdings. Better organisational efforts to provide infrastructural and input support to the small and marginal farmers are called for to meet the challenge of

agricultural development in this as well as other regions of the state.

Table IV.8 : Comparative Yield of Major Crops in Central Zone:
1983-86

(Qtls./ha.)

Crops	Uttar Pradesh	Western U.P.	Punjab	India
Rice	13.53(43.50)	17.46(56.14)	31.10(100.0)	14.80(47.59)
Wheat	19.21(58.57)	22.99(70.09)	32.80(100.0)	13.20(40.24)
Bajra	6.74(85.35)	6.68(84.77)	10.24(100.0)	5.30(51.76)
Maize	12.51(71.08)	14.95(84.94)	17.60(100.0)	13.26(75.34)
Barley	13.90(76.86)	17.51(96.85)	18.08(100.0)	12.30(73.56)
<u>Total Cereals</u>	15.53(50.14)	18.97(61.06)	31.07(100.0)	13.08(42.10)
Gram	8.80(124.65)	9.81(139.00)	7.06(100.0)	6.90(97.73)
Arhar	14.53(142.09)	14.96(146.09)	10.24(100.0)	7.92(77.34)
<u>Total Pulses</u>	9.04(133.93)	9.19(136.15)	6.75(100.0)	5.40(80.00)
<u>Total Foodgrains</u>	14.64(43.54)	18.02(59.75)	30.16(100.0)	11.66(38.66)
Oilseeds	6.07(65.69)	7.12(77.66)	9.24(100.0)	6.66(72.08)
Groundnut	6.36(72.85)	6.77(77.55)	8.73(100.0)	6.66(99.20)
Rapeseeds				
Mustard	6.82(68.30)	7.82(76.20)	10.00(100.0)	6.75(67.50)
Sugarcane	470.59(72.87)	499.10(77.28)	645.53(100.0)	575.43(89.56)
Potato	160.59(82.84)	184.81(95.32)	195.83(100.0)	142.24(73.38)

Source : Calculated from Agricultural Statistics of U.P. (Annual).

Note : Figures in parentheses show comparative yields in relation to yields in Punjab.

Table IV.9 : Indicators of Agricultural Development in
The Central Zone, Early 1980s

Indicators	Uttar Pradesh	Western U.P.	Punjab	India
1. Average Size of Holding. 1980-81	1.0	1.2	3.8	1.8
2. Proportion of Small and Marginal Holdings, 1980-81	86.9	81.8	38.6	74.6
3. Proportion of Area Under Small and Marginal Holdings, 1980-81	48.3	42.4	10.2	26.2
4. Gross Area Irrigated As Per cent of Gross Sown Area, 1980-83	45.1	63.9	53.8	31.0
5. Per cent Coverage of Area Under HYV, 1980-83				
(i) Paddy	48.6	58.3*	94.3	47.7
(ii) Wheat	77.8	99.7*	96.9	74.6
(iii) Maize	3.6	3.4*	35.7	27.9
6. Fertilizer Consumption kg. Per Ha., 1980-83	52.4	79.9	129.2	35.9
7. Tractors Per '000 ha., 1980-83	2.5	8.1	11.0	1.7
8. Pumpssets Per '000 ha.	25.3	43.1	74.6	27.6

Note : * Refers to 1990-91

Sources: For items 1 to 3 Census of Agricultural Holdings, 1980-81
and for items 4 to 8 G.S. Shaila and D.S. Tyagi, Pattern
of Indian Agricultural Development - A District Level
Study, Institute for Studies in Industrial Development,
New Delhi, 1989.

Appendix IV.2 : Trends In Production of Major Crops In Western U.P.
(1968-69 - 1987-88)

Year	Rice	Wheat	Jowar	Bajra	Maize	Barley	Total Cereals	Gram	Arhar	Total Pulses
1968-69	682	2937	66	407	625	220	4948	473	177	1045
1969-70	806	3314	64	495	603	308	5398	545	196	1089
1970-71	792	4057	8	822	1939	276	6870	383	180	876
1971-72	937	3978	45	438	701	281	6406	349	175	851
1972-73	755	3965	72	518	701	260	6275	320	511	767
1973-74	1055	2658	56	607	722	245	5348	253	312	439
1974-75	755	3447	49	325	412	456	5447	262	191	647
1975-76	1044	4079	68	496	603	427	6724	302	207	742
1976-77	1184	4483	56	538	532	330	7126	311	201	712
1977-78	1413	4676	69	404	390	304	7258	278	189	655
1978-79	1695	5468	45	403	333	304	8252	272	93	583
1979-80	772	4852	30	299	525	247	6726	143	94	399
1980-81	1575	6039	37	596	579	380	9257	221	183	590
1981-82	1357	5690	77	475	632	308	8539	203	127	545
1982-83	1386	7110	51	595	504	334	9981	252	117	617
1983-84	1791	7327	86	677	656	381	10918	179	115	501
1984-85	2006	7091	107	720	1147	341	11401	178	172	535
1985-86	2163	7654	58	439	899	430	11655	263	167	750
1986-87	7511	16237	467	774	1481	600	27634	1233	684	2666
1987-88	6477	16789	440	616	997	776	26334	1056	605	2362

(Contd.....)

(Appendix IV.1 contd..)

Year	Total Kharif Food- grains	Total Rabi Food- grains	Total Food- grain- ns	Total Oil- seeds	Ground Nut	Rape- seed & Must- ard	Sugar cane	Potato
1968-69	1805	4128	5993	145	119	29	30027	740
1969-70	1988	4700	6688	169	129	39	36891	509
1970-71	2551	5196	7746	174	109	64	32532	646
1971-72	2156	5102	7237	163	109	52	31562	729
1972-73	2064	4973	7042	204	149	37	34832	717
1973-74	2460	3327	5787	205	139	44	40002	760
1974-75	1555	4539	6094	286	163	122	40669	1014
1975-76	2224	5239	7463	241	150	87	38998	1119
1976-77	2319	5519	7838	180	115	63	43147	1017
1977-78	2287	5606	7893	195	107	85	53594	1369
1978-79	2437	6326	8835	155	75	78	41962	2067
1979-80	1639	5461	7125	99	55	44	35460	1547
1980-81	2856	6958	9847	220	83	135	45695	2244
1981-82	2856	6483	9084	329	129	196	51185	2316
1982-83	2548	7993	10600	232	102	127	56357	2138
1983-84	3216	8158	11419	225	78	144	54095	3105
1984-85	3971	7924	11941	326	35	286	50050	2965
1985-86	3568	8767	12405	308	41	263	49283	2220
1986-87	40630	19564	30300	426	111	234	84736	5695
1987-88	8811	49793	28696	468	75	356	93054	6331

Source : Calculated from Agricultural Statistics, U.P. (Annual)

Appendix IV.2 : Trends In Yield of Major Crops In Western U.P.
(1968-69 = 1985-86)

(Quintals/Hectare)

Year	Rice	Wheat	Jowar	Bajra	Maize	Sar- ley	Total Cereals	Gram	Arhar	Total Pulses
1968-69	7.46	13.15	3.57	5.38	9.57	8.21	9.84	7.71	11.11	8.59
1969-70	9.05	14.05	3.74	6.96	8.72	11.87	10.98	9.14	13.64	9.72
1970-71	9.05	15.39	4.70	7.87	14.20	12.74	12.65	7.86	13.37	9.43
1971-72	10.04	14.59	2.92	6.22	8.74	12.85	11.50	6.13	14.42	9.44
1972-73	9.05	14.19	4.68	6.84	9.47	11.80	11.35	8.02	16.86	9.06
1973-74	11.28	10.00	3.79	7.72	9.58	9.75	9.65	5.89	2.68	5.17
1974-75	8.69	13.53	3.66	4.54	6.10	13.02	10.28	7.05	18.12	8.69
1975-76	11.13	15.80	5.22	6.79	8.44	12.42	12.34	6.46	21.53	10.12
1976-77	12.58	15.95	4.91	7.30	8.20	12.10	12.88	9.86	20.92	10.72
1977-78	11.89	17.01	6.31	5.72	7.28	12.36	13.53	8.75	20.93	10.01
1978-79	14.03	13.15	4.54	5.95	6.30	13.07	14.45	8.59	11.33	7.98
1979-80	7.71	16.11	2.68	3.86	9.57	11.00	11.69	5.83	9.10	5.96
1980-81	13.83	19.40	6.55	7.87	9.33	15.48	15.45	9.00	14.58	8.83
1981-82	12.93	19.64	6.57	6.59	10.70	13.80	15.21	6.63	13.02	7.36
1982-83	12.77	22.56	5.35	8.31	9.48	16.07	17.63	11.03	12.80	9.34
1983-84	14.77	22.26	7.96	8.66	11.00	17.55	18.06	9.18	12.12	8.31
1984-85	17.43	22.16	9.54	10.21	18.61	16.62	19.03	9.11	17.53	8.93
1985-86	18.53	24.63	5.95	6.99	13.99	15.25	19.85	10.79	15.13	10.13
1986-87	13.55	19.32	8.07	9.04	12.28	14.71	15.76	8.26	13.80	8.57
1987-88	13.54	19.79	7.46	7.64	8.78	14.66	15.79	7.55	11.77	7.93

(Contd...)

(Appendix IV.2 contd....)

Year	Total Kharif Food- grains	Total Rabi Food- grains	Total Food- grain- ns	Total Oil- seeds	Ground Nut	Rape- seed & Mus- tard	Sugar cane	Potato
1968-69	7.05	11.37	9.60	5.39	6.14	5.43	429.64	95.67
1969-70	7.90	12.68	10.75	6.59	7.11	5.60	457.96	82.20
1970-71	9.77	13.75	12.12	6.32	5.91	7.43	420.01	93.91
1971-72	8.09	13.39	11.21	4.91	5.36	5.33	429.05	95.89
1972-73	8.10	13.00	11.04	7.81	9.26	5.79	470.43	94.97
1973-74	9.20	8.95	9.03	6.96	7.73	6.08	450.13	93.69
1974-75	6.32	12.58	10.08	6.90	7.29	6.92	438.25	106.30
1975-76	8.71	14.44	12.08	6.13	6.49	6.27	436.37	134.18
1976-77	9.35	14.81	12.63	5.02	5.75	4.39	470.85	130.47
1977-78	9.54	13.54	13.16	5.31	6.46	4.62	500.65	153.15
1978-79	9.93	16.33	13.71	4.87	4.58	5.52	399.34	157.53
1979-80	6.38	14.92	11.09	4.25	4.39	4.44	405.91	129.73
1980-81	10.61	17.91	14.79	6.43	7.71	6.21	509.14	180.78
1981-82	10.07	17.43	14.30	7.51	8.96	7.18	471.32	168.35
1982-83	10.84	20.64	16.76	5.72	6.52	5.61	489.26	168.84
1983-84	12.48	20.59	17.18	7.27	7.25	7.94	492.93	214.34
1984-85	15.13	20.55	18.11	7.47	4.71	8.53	496.55	187.95
1985-86	13.83	22.44	18.77	6.69	9.09	6.70	509.36	152.09
1986-87	12.09	16.75	14.67	5.91	9.00	5.55	505.09	193.37
1987-88	11.21	17.06	14.60	5.87	6.51	5.90	516.68	193.73

Source : Calculated from Agricultural Statistics, U.P.
(Annual)

CHAPTER V

LIVESTOCK RESOURCES

V.1 Introduction

Animal husbandry is an important component of the rural economy of Western U.P., next only to agriculture. In U.P. income from animal husbandry in 1981-82 was estimated at Rs.1903 crores, which was about 24 per cent of agricultural income and 13 per cent of the total income of the state. Comparable figures on these items are not available for West U.P. but the importance of the animal husbandry is not likely to be any less there as compared to the state as a whole. At the same time livestock put pressure on the limited land resources causing environmental degradation.

V.2 Livestock Number and Density

According to Livestock Census, 1982 total number of livestock in West U.P. was 173.33 lakhs, which comes to 30.6 per cent of total livestock in the state. The composition of the livestock in the region has been shown in Table V.1. Cattle and buffalo account for over three-fourths of total livestock in the states. The proportion of buffaloes is significantly larger in West U.P. as compared to U.P. as a whole. In fact nearly 50 per cent of total buffaloes in the state are found in the Western region. Goats are also found in large numbers in the region though the number of sheep is relatively small.

Table V.1 Composition of Livestock in West U.P., 1982

Category	Uttar Pradesh		West U.P.		West U.P. As Per- cent of U.P.
	Number ('000)	percent	Number ('000)	percent	
1. Cattle	26151	46.09	5766	33.27	22.05
(i) Male	19534	34.43	3792	21.88	19.41
(ii) Female					
a) In Milk	3200	5.64	707	4.08	22.09
b) Total	6617	11.66	1974	11.39	29.53
2. Buffaloes	15785	27.83	7890	45.52	49.98
(i) Male	7879	13.89	2307	13.31	29.25
(ii) Female					
a) In Milk	4593	8.10	2321	13.39	50.53
b) Total	7906	13.93	5583	32.21	70.62
3. Total Cattle and Buffaloes	41936	73.92	13656	78.79	32.56
4. Sheep	2307	4.07	362	2.09	15.69
5. Goats	9683	17.07	2435	14.05	25.14
6. Horses and Ponies	212	0.37	126	0.73	59.43
7. Pigs	2281	4.02	609	3.51	26.70
8. Camels	40	0.07	13	0.08	32.50
9. Others	273	0.48	132	0.76	48.35
Total Livestock	56735	100.00	17333	100.00	30.55

Source: Livestock Census, 1982.

The livestock in the Western Region consists mostly of local non-descript type animals. The proportion of cross-bred cows was 8.0 per cent, while that of sheep was 7.5 per cent in 1982 (Table V.2).

Table V.2 : Distribution of Livestock According to Breed, 1982

Category	Uttar Pradesh	West U.P.
1. <u>Buffaloes</u>		
(a) Cross Bred	14.8	10.8
(b) Local	85.2	89.2
(c) Total	100.0	100.0
2. <u>Cows</u>		
(a) Cross Bred	8.9	8.0
(b) Local	91.1	92.0
(c) Total	100.0	100.0
3. <u>Sheep</u>		
(a) Cross Bred	7.7	7.5
(b) Local	92.3	92.5
(c) Total	100.0	100.0

Source: Directorate of Animal Husbandry, U.P.

To examine the pressure of livestock population on land resources we have converted the livestock population of different categories and ages into livestock units based on standard animal feed as recommended by the Indian Council of Agricultural Research. For purposes of conversion adult cows, buffaloes, bullocks, horses, ponies have been taken as equivalent of 1

livestock unit, their youngstock between 1-3 years equivalent to $1/2$ unit and youngstock below 1 year equivalent to $1/3$ unit, 1 camel has been treated as equal to 2 units and 1.5 donkeys, 7 sheep, 6 pigs and 100 poultry equal to 1 unit.

Indicators of livestock density have been shown in Table V.3. Per hectare of net sown area livestock density comes to 2.0 in U.P. and 1.9 in West U.P., while it is regarded that normally one hectare of cropped area cannot support more than 1 livestock unit in irrigated area and about $1/2$ livestock unit in rainfed areas. As the table reveals there is an excessive pressure of livestock population in relation to area under fodder crops as well as area under pastures and grazing land in the state as well as the Western region, though the situation is relatively better in the latter as far as fodder crops are concerned.

In relation to veterinary facilities also the number of livestock in the Western Region as well as in the state is very large as can be seen from Table V.4.

V.5 Growth of Livestock

Table V.5 shows the growth of livestock population by category during 1966-82 in West U.P. The number of livestock has increased at the rate of 1.34 per cent per annum over the period in West U.P. as compared to a growth rate of 0.79 per cent in U.P. The livestock of various categories do not show a uniform trend. Thus, the number of cattle has been declining slowly but that of buffaloes has been increasing sharply. This mainly reflects the

Table V.3 : Districtwise Livestock Density in Western Uttar Pradesh, 1982

Districts	Total Livestock Units Per hectare of				Ratio of Fodder Crops to Total Cropped Area
	Live-stock Units ('000)	Net Area Sown	Area Under Fodder Crops	Area Under Pastures & Grazing Land	
1. Agra	552	1.6	25	377	4.74
2. Aligarh	784	2.0	22	273	4.97
3. Bareilly	563	1.7	29	1271	4.15
4. Bijnor	580	1.7	13	823	10.55
5. Budaun	649	1.6	94	923	1.29
6. Bulandshahr	739	2.2	12	430	10.66
7. Etah	563	1.9	74	482	1.73
8. Etawah	531	1.8	79	231	1.69
9. Farrukhabad	518	1.8	131	182	1.05
10. Ghaziabad	516	2.7	10	1025	17.55
11. Meerut	739	2.4	8	1381	19.23
12. Mainpuri	547	1.9	79	185	1.82
13. Mathura	499	1.6	13	289	9.08
14. Moradabad	843	1.7	15	776	8.91
15. Muzaffarnagar	739	2.2	8	922	13.51
16. Pilibhit	313	1.4	23	1474	3.66
17. Ramour	294	1.6	19	13378	6.32
18. Saharanpur	514	2.1	2	1609	16.46
19. Shahjahanpur	530	1.5	30	414	3.37
West U.P.	11313	1.9	16	468	7.87
Utar Pradesh	34444	2.0	40	112	3.62

Source: Calculated from Livestock Census, 1981 and Agricultural Statistics of U.P.

substitution of milch buffalo in place of low milk yielding cows. Sheep reveal a sharp decline in their numbers but goats show a sharp rise. Pig population has risen very sharply over time as also poultry population.

Different statistical functions were fitted on quinquennial

livestock Census during the period 1951 and 1982 for different

Table V.4 : Development of Veterinary Facilities in West U.P., 1987-88

Veterinary Facility	U.P.	West U.P.
A. <u>Actual Number of Veterinary Facility</u>		
(i) Veterinary Hospitals	1610	426
(ii) Veterinary Dispensaries	234	68
(iii) Stockman Centres	2637	829
2. <u>Number of Livestock Per Veterinary hospitals</u>		
(i) Veterinary Hospitals	38	45
(ii) Veterinary Dispensaries	261	279
(iii) Stockman Centres	23	23

Source: Animal Husbandry Statistics of Uttar Pradesh, 1988-89

categories of livestock in the state, since the growth pattern has been quite erratic over time none of the functions showed a good fit. Therefore, we have made the simple assumption that livestock in different categories will continue to increase at the rate of growth observed during the period 1966 and 1982. Projected livestock population by categories is also shown in Table V.5.

V.4 Livestock Output

As the livestock in the state is generally of poor quality and remain undernourished the yields levels are quite low. However, the situation is somewhat better in the Western region of the State. Average daily milk yield in the Western region in

1989-90 was 2.82 Kg. per cow and 3.74 per buffalo which compares

Table V.5 : Growth of Livestock Population in West U.P.

(Nos. in '000)

Livestock Category	1966	1982	Annual Growth Rate 1966-82	Projected Population	
				2000	2010
1. Total Cattle	6213	5766	-0.43	5305	5016
2. Total Buffaloes	5364	7890	2.41	12151	15622
3. Sheep	511	362	-1.39	243	155
4. Goat	1343	2435	3.70	4724	6842
5. Horses & Ponies	98	99	0.06	100	101
6. Mules	16	28	3.30	53	74
7. Donkeys etc.	104	132	1.49	173	201
8. Camels	28	13	-2.70	5	3
9. Pigs	312	609	4.18	1291	1961
10. Total Livestock	13989	17333	1.34	22013	25133
11. Poultry	1150	1816	2.86	3051	4032

Source: Livestock Census 1966 and 1982.

favourably with the average yield of 2.02 Kg. per cow and 3.40 per buffalo in the state as a whole. Average milk yield is particularly high in the Meerut division of West U.P. (Table V.6).

West U.P. is a major milk producing region of the state and contributes nearly 30 per cent of cow milk, 57 per cent of buffalo milk and 49 per cent of total milk production in the State. Meerut division alone contributes 22.2 per cent of total milk output in the state (Table V.7).

Table V.6 : Divisionwise Average Daily Milk Yield in U.P.

(Kgs.)

Division	Per Cow			Per Buffalo		
	1976-77	1989-90	% inc- rease	1976-77	1989-89	% inc- rease
Nainital	1.03	1.60	55.3	2.09	2.87	37.3
Pauri	1.06	1.54	42.5	1.77	2.84	60.5
Meerut	2.16	3.39	56.9	3.96	5.04	27.3
Bareilly	1.81	2.27	25.4	2.71	3.15	16.2
Agra	1.98	2.61	31.8	2.86	3.33	16.4
Lucknow	1.44	2.04	41.7	2.30	3.13	36.1
Faizabad	1.69	1.55	-8.3	2.40	2.73	13.8
Allahabad	1.63	1.99	22.1	2.83	2.77	-2.1
Jhansi	1.17	1.79	53.0	2.37	2.78	17.3
Gorakhpur	1.12	2.09	86.6	3.48	3.22	-29.8
Varanasi	1.34	1.81	35.1	2.63	3.09	17.5
Uttar Pradesh	1.49	2.02	35.6	2.76	3.40	23.2
West U.P.*	1.96	2.82	43.9	3.16	3.74	17.6
West U.P. as % of U.P.	131.54	143.68	123.3	115.22	110.00	75.9

Source : Directorate of Animal husbandry, U.P.

* Weighted average of Meerut, Bareilly and Agra Divisions, Bareilly division includes districts of Moradabad division also.

Table V.7 : Districtwise Total Milk Output in U.P.

(Lakh Tonnes)

Division	Cow Milk			Buffaloe Milk			Total Milk Output		
	1976-77	1989-90	% In-crease	1976-77	1989-90	% In-crease	1976-77	1989-90	% In-crease
Naini Tal	0.61	0.96	57.4	1.08	1.72	59.3	1.69	2.67	58.0
Pauri	0.62	1.08	74.2	0.82	1.45	76.8	1.44	2.53	75.7
Meerut	1.72	2.95	71.5	7.76	16.22	109.0	9.48	19.17	102.5
Bareilly	1.93	2.51	30.1	4.94	7.90	59.9	6.92	10.41	50.4
Agra	0.35	1.41	65.9	6.15	8.72	41.8	7.00	10.15	44.7
Lucknow	1.58	3.66	131.6	2.21	4.64	110.0	3.79	8.29	118.7
Faizabad	2.61	2.18	-16.5	3.32	3.64	9.6	5.98	5.82	-2.7
Allahabad	1.90	2.73	43.7	3.96	6.03	52.3	5.86	8.76	50.0
Jhansi	1.23	2.24	82.1	1.66	2.55	53.6	2.90	4.79	65.2
Gorakhpur	1.40	2.30	64.3	2.50	3.98	59.2	3.90	6.28	61.0
Varanasi	1.74	3.20	83.9	2.67	4.22	58.1	4.41	7.42	68.2
Uttar Pradesh	16.27	25.21	54.9	37.08	61.07	64.7	53.35	86.28	61.7
West U.P.*	4.91	7.40	50.7	20.30	34.60	70.4	25.21	42.00	66.6
West U.P. as Per cent of U.P.	30.16	29.35	92.3	54.75	56.66	103.8	47.25	48.68	107.9

Source : Directorate of Animal Husbandry, U.P.

* Includes total of Meerut, Bareilly and Agra divisions plus imputed output of Farrukhabad and Etawa districts.

In the recent years milk production in the region has increased at a fairly rapid rate. Thus, between 1976-77 and 1989-90 milk output increased by 66.6 per cent in West U.P. as compared to an increase of 61.7 per cent in the state. These figures imply a growth rate of 3.95 and 3.75 per annum respectively.

Total egg output in the region is estimated at 1233.9 lakhs in 1989-90, which comes to 29.4 per cent of the egg output in the state. The increase in the output of eggs in the region has also been very high though slightly less than the state average (Table V.8).

Table V.8 : Egg Production In West U.P.

Region	(Nos. in lakhs)		
	1976-77	1989-90	Per cent Increase
West U.P.	707.3	1233.9	74.5
Uttar Pradesh	2257.6	4197.1	85.9
West U.P. As per cent of Uttar Pradesh	31.3	29.4	66.7

Source: Directorate of Animal Husbandry, U.P.

The share of West U.P. in wool output is rather low (hardly 12.9 per cent) and has gone down over the years (Table V.9).

Table V.9 : Wool Production in West U.P. (Lakh Kg.)

Region	1976-77	1989-90	Per cent Increase
West U.P.	2.06	2.40	16.5
Uttar Pradesh	12.64	18.67	47.7
West U.P. As percent of U.P.	16.3	12.9	34.6

Source: Directorate of Animal Husbandry, U.P.

Information about meat output is confined to the number of animals slaughtered in the registered slaughter houses. The Directorate of Animal Husbandry has estimated the output of meat in U.P. at 715.2 lakh Kg. in 1989-90, out of which the share of West U.P. comes to 415.9 lakh Kg. or 58.1 per cent. Meat output has more than doubled in the last 13 years (Table V.10).

Table V.10 : Meat Output In West U.P. (lakh kg.)

Item	1977-78		1988-89		Per cent Increase	
	West U.P.	U.P.	West U.P.	U.P.	West U.P.	U.P.
Sheep Meat	4.7	17.6	2.5	24.7	-46.8	40.3
Goat Meat	16.5	76.0	41.3	159.8	150.3	110.3
Pig Meat	5.2	9.6	16.5	25.9	217.3	169.8
Buffaloe Meat	162.1	249.0	355.6	504.8	119.4	102.7
Total Meat	188.5	352.2	415.9	715.2	120.6	103.1

Source : Directorate of Animal Husbandry, U.P.

Fish output in U.P. has been officially estimated at 90.6 thousand tonnes in 1968-69. If we assume that the share of West U.P. in fish production of the state is around 20 per cent, fish output in the region can be tentatively placed at 18.1 thousand tonnes.

The per capita output of major livestock product in the region comes to 85.02 Kg. in case of milk and only 0.84 Kg. in case of meat, while only 2.5 eggs are produced per capita. Since a good part of this is sent to outside markets particularly Delhi, the actual consumption levels must be even lower.

We have estimated that demand for milk will increase at a rate of 5 per cent per annum over the next two decades. The increase in demand for egg, meat and fish can also reasonably be expected to be of the same order. Though the growth rates of livestock output have been fairly high in the recent past, these have to be sustained over the coming decades.

V.5 Fodder Requirement and Availability

We have worked out the estimates of the requirement and availability of feed and fodder for livestock in the region broadly following the methodology and norms suggested by the National Commission on Agriculture, 1976. As shown in Table V.11 the region is surplus in terms of availability of green fodder, but there is a substantial shortage in the supply of dry fodder and concentrates. The problems of inadequacy of animal feed is likely to become more acute as the number of livestock is likely to go up by about 45 per cent between 1982 and 2010.

The problem of availability of grazing land is even more acute in the Western region. There are as many as 13.45 livestock units per hectare of grazing area in the region as compared to a

Table V.11 : Availability and Requirement of Feeds and Fodder in West U.P., 1981-82

(In lakh tonnes)

Item	Availability	Requirement	Availability as Per cent of Requirement
Dry Fodder	103.3	164.2	62.9
Green Fodder	287.5	238.8	120.4
Concentrates	7.1	26.3	27.0

figure of 4.33 in the state as a whole (Table V.12). The shortage of grazing land is, however, counterbalanced to a large extent by the relatively greater proportion of area under fodder crops in the region.

Table V.12 : Area Under Major Categories of Land Providing Grazing in Central Zone : Early 1980's

Land Use Category	Area in Lakh Hectares	
	Uttar Pradesh	West U.P.
1. Forests	51.25	3.84
2. Permanent Pastures and Grazing Land	3.19	0.24
3. Culturable Wastelands	11.26	1.80
4. Fallow Land other than Current Fallow	7.84	2.00
5. Area under Miscellaneous Tree Crops and Grasses	5.67	0.53
6. Total Area Under 1 - 5	79.21	8.41
7. Number of Livestock Units (Lakhs)	344.44	113.13
8. Livestock Units Per Hectare of Grazing Area	4.35	13.45

The problem of availability of grazing land is even more acute in the Western region. There are as many as 13.45 livestock units per hectare of grazing area in the region as compared to a

Table V.11 : Availability and Requirement of Feeds and Fodder in West U.P., 1981-82

(In lakh tonnes)

Item	Availability	Requirement	Availability as Per cent of Requirement
Dry Fodder	103.3	164.2	62.9
Green Fodder	287.5	238.8	120.4
Concentrates	7.1	26.3	27.0

figure of 4.35 in the state as a whole (Table V.12). The shortage of grazing land is, however, counterbalanced to a large extent by the relatively greater proportion of area under fodder crops in the region.

Table V.12 : Area Under Major Categories of Land Providing Grazing in Central Zone : Early 1980's

Land Use Category	Area in Lakh Hectares	
	Uttar Pradesh	West U.P.
1. Forests	51.25	3.84
2. Permanent Pastures and Grazing Land	3.19	0.24
3. Culturable Wastelands	11.26	1.80
4. Fallow Land other than Current Fallow	7.84	2.00
5. Area under Miscellaneous Tree Crops and Grasses	5.67	0.53
6. Total Area Under 1 - 5	79.21	8.41
7. Number of Livestock Units (Lakhs)	344.44	113.15
8. Livestock Units Per Hectare of Grazing Area	4.35	13.45

V.8 Strategy of Livestock and Fodder Development

Development of animal husbandry in the region needs maximum encouragement to supplement income as well as to generate additional employment. The demand for various livestock products is expected to rise rapidly with rising incomes. The region offers great potential for development of animal husbandry. However, the present number of livestock is excessive and its productivity is quite low, though somewhat better than in other regions of the state.

The strategy of livestock development should aim at reduction in its number and improvement in the quality of the livestock through cross breeding. Secondly, the infrastructure of veterinary services, which is very inadequate, has to be expanded and streamlined.

The success of livestock development programme cannot be ensured without arrangement of adequate quantity of good quality feed and fodder. The National Commission on Agriculture and the committee on Fodder and Grasses have given very useful and detailed suggestions in this respect, which need urgent consideration and action. Farmers have to be encouraged to take up cultivation of green fodder crops on a commercial basis and should be provided with good quality seed and other inputs, particularly in districts where area under fodder crops is relatively low.

CHAPTER VI

LAND USE PATTERN AND TRENDS

VI.1 Introduction

Land use pattern has important implications for the economic growth and environmental balance in any region. In the present chapter we propose to discuss the land use pattern and trends in the Western Region of U.P. The analysis is based upon the Revenue Board data which gives yearwise information about area under nine land use categories. The data have been taken from the Bulletin of Agricultural Statistics published annually by the Directorate of Agriculture, U.P. The analysis broadly covers the period 1956-57 to 1985-86. Apart from the analysis at the regional level, we have highlighted some aspects of land use at the district level also.

VI.2 Regional Level Land Use Pattern

Table VI.1 shows the area under different land use categories in the Western Region for the six quinquenniums between 1956-57 and 1985-86. Looking at the picture for the quinquennium ending 1985-86 we find that of the total 82.07 lakh hectares of reported area 60.77 lakh hectares (74.04 per cent) are under cultivation while another 2.62 lakh hectares (3.20 per cent) are under current fallows and 2.00 lakh hectares (2.44 per cent) are under old fallows. Thus nearly 80 per cent of the total area, which has a favourable topography and climate for

agriculture, has already been brought under the plough, while 1.80 lakh hectares (2.19 per cent) are classified as culturable waste.

Table VI.1 : Trends In Land Use Pattern in West U.P. - 1956-57 to 1985-86.

(lakh ha.)

Land Use Category	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86
1. Reporting Area	84.11 (100.00)	83.29 (100.00)	82.99 (100.00)	82.26 (100.00)	82.28 (100.00)	82.07 (100.00)
2. Forests	4.65 (5.53)	4.03 (4.83)	3.96 (4.77)	3.83 (4.66)	3.83 (4.66)	3.84 (4.67)
3. Land Put To Non-Agricultural Uses	5.86 (6.97)	6.24 (7.50)	6.68 (8.05)	6.90 (8.39)	7.20 (8.76)	7.48 (9.11)
4. Barren and Uncultivable Land	3.99 (4.75)	3.92 (4.70)	3.61 (4.35)	3.37 (4.10)	3.10 (3.76)	2.80 (3.41)
5. Permanent Pastures and Other Grazing Land	0.05 (0.06)	0.15 (0.18)	0.24 (0.28)	0.26 (0.31)	0.25 (0.31)	0.24 (0.29)
6. Land Under Misc. Tree Crops & Groves	1.63 (1.94)	1.21 (1.46)	1.21 (1.46)	1.16 (1.41)	0.81 (0.98)	0.53 (0.64)
7. Culturable Waste Lands	4.07 (4.84)	3.69 (4.43)	3.21 (3.87)	2.88 (3.50)	2.21 (2.68)	1.80 (2.19)
8. Current Fallows	0.93 (1.12)	1.67 (2.01)	2.73 (3.29)	3.04 (3.69)	3.04 (3.69)	2.62 (3.20)
9. Old Fallows	3.34 (3.97)	2.48 (2.98)	1.22 (1.47)	1.31 (1.59)	1.39 (1.68)	2.00 (2.44)
10. Net Area Sown	59.57 (70.82)	59.89 (71.90)	60.14 (72.46)	59.51 (72.34)	60.25 (73.23)	60.77 (74.04)

Sources: Calculated from Bulletin of Agricultural Statistics, U.P.
(Annual)

Note : Figures in parentheses show percentage to total area.

Forest coverage in the region is extremely low - 3.84 lakh hectares (4.67 per cent). Area under miscellaneous tree crops and groves is also scanty, only 0.52 lakh hectares (0.64 per cent). Pastures and grazing lands are now almost extinct, merely 0.24 lakh hectares (0.29 per cent). 2.80 lakh hectares (3.41 per cent) are classified as barren and uncultivable land.

Area under non-agricultural uses has been rapidly rising and is currently reported at 7.48 lakh hectares which comes to 9.11 per cent of the reported area.

VI.3 Regional Level Trends In Land Use

Periodwise shifts in area under different land use categories in West U.P. since 1956-57 have been shown in Table VI.2. Over the entire period total reported area of the region has declined by about 2 lakh hectares or nearly 2.43 per cent. The reason for this decline could not be ascertained. Net sown area, area under current fallows and land put to non-agricultural uses show significant increases over the entire period, while all other categories show a decline.

Due to the process of urbanization, expansion of road network and other developmental activities area under non-agricultural uses has been steadily increasing. Over the recent period an additional area of nearly 6,000 hectares is being put to non-agricultural uses every year, which does not appear to be a very large or alarming rate of increase. Moreover, the rate of expansion of area under non-agricultural uses has slowed down since the mid-sixties.

Table VI.2 : Periodwise Shift in Area Under Different Land Use Categories in West U.P. - 1956-57 to 1985-86.

('000 hectares)

Land Use Category	1961-66	1966-71	1971-76	1976-81	1981-86	1981-86
	over 1956-65	over 1961-66	over 1966-71	over 1971-76	over 1976-81	over 1956-81
1. Reporting Area	-82.1 (-0.98)	-30.4 (-0.36)	-73.73 (-0.88)	2.5 (0.03)	-21.1 (-0.26)	-204.4 (-2.43)
2. Forests	-62.4 (-13.43)	-6.9 (-1.70)	-12.7 (-3.20)	-	0.6 (0.15)	-81.4 (-17.5)
3. Land Put To Non-Agricultural Uses	38.2 (6.52)	43.6 (6.98)	21.8 (3.26)	30.6 (4.43)	27.7 (3.85)	161.9 (27.62)
4. Barren and Uncultivable Land	-7.6 (-1.91)	-30.5 (-7.77)	-23.7 (-6.56)	-27.7 (-8.22)	-29.9 (-9.66)	-119.5 (-29.92)
5. Permanent Pastures and Other Grazing Land	10.2 (207.72)	8.6 (56.95)	2.0 (8.58)	-0.5 (-1.92)	-1.7 (-6.74)	18.6 (379.68)
6. Land Under Misc. Tree Crops & Groves	-41.8 (-25.60)	-0.6 (-0.45)	-4.6 (-3.84)	-35.4 (-30.45)	-28.2 (-34.88)	-110.6 (-67.74)
7. Culturable Waste Lands	-37.7 (-9.26)	-48.5 (-13.13)	-32.9 (-10.25)	-67.4 (-23.42)	-40.5 (-18.38)	-227.12 (-55.79)
8. Current Fallows	72.77 (76.85)	105.8 (63.27)	30.7 (11.22)	-	-41.6 (-13.68)	167.7 (177.22)
9. Old Fallows	-86.0 (-25.72)	-126.4 (-50.93)	9.0 (7.29)	28.2 (21.56)	41.2 (25.90)	-134.0 (-40.10)
10. Net Area Sown	32.3 (0.54)	24.3 (0.41)	-62.9 (-1.04)	74.8 (1.26)	51.4 (0.85)	119.9 (2.01)

Source: Calculated from Bulletin of Agricultural Statistics, U.P. (Annual).

Note : Figures in parentheses show percent change over the period.

Forest area has declined by 81.4 thousand hectares over the entire period. However, the decrease took place mainly during the period upto 1970-71, after which area under forest has stabilised reflecting the policy shift. Land under miscellaneous tree crops and groves also shows a sharp decline due to the pressure for bringing more area under cultivation. Area under pastures and grazing land has also shown a declining trend after 1970-71.

Area under cultivable as well as non-cultivable wasteland has shown a steady and marked decline. Current fallows reveal a sharp increase over the period, whereas the old fallows have shrunk considerably. Over the last decade, however, the trend has been in the opposite direction with current fallows showing a decline and the old fallows showing a rise.

With increasing pressure of population expansion of irrigation facilities and growing profitability of agriculture, net sown area in the region, unlike other parts of the state, shows an almost continuous increase. Over the period nearly 1.2 lakh hectares have been brought under the plough.

Looking at the shifts in the per cent area under different land use categories we find that per cent of area under forests, barren lands, miscellaneous trees and groves, culturable wastelands and old fallows has registered a negative shift while area under non-agricultural uses, permanent pastures, current fallows and net sown area have registered a positive shift. In short, the green cover, which was already quite low in the

region, has further depleted over the years. While the intensive and extensive margin of cultivation has been increasing.

VI.4 District Level Pattern of Land Use

Within the Western Region of U.P. one finds important differences in the pattern and trends in land use, which must be kept in mind while preparing area specific land use plans. Total area under different land use categories in different districts for the period 1983-86 has been presented in Table VI.3, while percentage distribution is given in Table VI.4. We briefly discuss the inter-district variations in land use pattern below.

Forests: Forest coverage meagre as it is highly unevenly distributed over space in the region (Map VI.1). Three districts on northern lari (Bijnor, Pilibhit and Saharanpur) have somewhat adequate forest cover around 15 per cent or more of total area. Agra and Etawah on the southern fringe also have 8-9 per cent area under forests. Remaining districts have been almost completely denuded of their forest wealth. These district should receive special attention under various forestry programmes.

Land Under Non-Agricultural Uses: Land under this category varies from 6.64 per cent of area to 13.43 per cent (Map VI.2). In general the proportion of area under non-agricultural uses is related to the degree of urbanization and is higher in the

Table VI.3 : Land Use Statistics for Western Uttar Pradesh
(Average of 1983-84, 1984-85 and 1985-86)

(Area in hectares)

Districts	Reported area for land utilisation purpose	Forests and un-cultivable land	Barren and uncultivable land	Land put to non-agricultural uses	Permanent pastures & other grazing land	Culturable waste Land	Land under misc. trees & graves	Current fallow	Other fallow land	Net sown area
1. Agra	477037	39616	13840	38255	1291	6535	1381	18425	11469	346226
2. Aligarh	502461	862	32940	40063	2809	9037	1139	13518	11416	390627
3. Bareilly	407490	287	12941	41405	437	3775	1089	9765	5337	332453
4. Bijnor	490242	70106	8131	32348	745	3376	2675	5382	2610	344869
5. Budaun	521162	6912	16357	41512	703	7448	8763	24851	13531	401085
6. Bulandshahr	436459	9370	15277	36769	1651	10910	2161	10439	9038	340843
7. Etah	444398	1107	12163	39693	1083	38618	3086	24008	2811	296510
8. Etawah	436623	39269	26403	32347	2271	10640	1387	18444	17057	288805
9. Farrukhabad	427890	4182	22040	40734	3146	20854	10471	24270	22132	280061
10. Ghaziabad	259254	2574	9715	34821	517	7233	1074	7688	7741	187890
11. Meerut	391714	7992	6445	46182	443	4261	416	7291	5569	313116
12. Mainpuri	423713	6456	38403	28749	2693	15071	2712	23950	29473	285221
13. Mathura	377091	1581	6439	29914	1732	7034	1340	10865	9383	308801
14. Moradabad	593579	11921	14604	46486	1062	10259	2294	16351	7165	483437
15. Muzaffarnagar	417729	7354	11804	47380	739	4622	1595	6671	4583	332981
16. Pilibhit	349059	78646	4774	29139	276	4875	2461	4702	4169	220016
17. Rampur	235447	6611	7629	23466	12	1094	391	3966	2057	190220
18. Saharanpur	549898	78679	8160	66328	515	5002	1176	6548	3659	381632
19. Shahjahanpur	457350	10538	10831	37544	1326	7583	5538	23218	11662	349111
Western Region	8207588	384064	276918	753335	23452	178277	51148	260344	204159	6073895

Source: Agricultural Statistics for Uttar Pradesh (Annual)

north-western districts including Saharanpur, Muzaffarnagar, Bijnor, Meerut and Ghaziabad. In all other districts except Bareilly less than 10 per cent of the area is under non-agricultural uses.

Table VI.4 : Districtwise Percentage of Area Under Different Land Use Categories to Total Reporting Area in Western Uttar Pradesh,
(Average For 1983-84, 1984-85 and 1985-86)

(Area in per cent)

Districts	Barren Forests and uncultivable land	Land and non-agricultural uses	Perma-put to non-pastures & other grazing land	Cul-tur-able waste	Land under misc. trees & groves	Current fallow	Other fall-ow land	Net area sown	Total reported Area
1. Agra	8.30	2.91	8.01	0.27	1.36	0.29	3.87	2.41	72.58 100.0
2. Aligarh	0.18	6.56	7.97	0.55	1.80	0.23	2.69	2.28	77.74 100.0
3. Bareilly	0.07	3.18	10.16	0.10	0.92	0.27	2.40	1.31	81.59 100.0
4. Bijnor	14.30	1.66	10.67	0.15	0.68	0.55	1.10	0.54	70.35 100.0
5. Budaun	1.33	3.14	7.96	0.13	1.42	1.69	4.77	2.60	76.96 100.0
6. Bulandshahr	2.15	3.50	8.42	0.37	2.45	0.50	2.40	2.07	78.09 100.0
7. Etah	0.25	2.75	8.93	0.24	8.68	0.70	3.41	6.33	66.71 100.0
8. Etawah	9.00	6.04	7.40	0.52	2.43	0.32	4.23	3.91	66.15 100.0
9. Farrukhabad	0.98	5.15	9.51	0.73	4.87	2.45	5.68	5.18	63.43 100.0
10. Ghaziabad	0.99	3.75	13.43	0.20	2.79	0.41	2.97	2.99	12.47 100.0
11. Meerut	2.04	1.65	11.79	0.11	1.09	0.11	1.86	1.42	79.93 100.0
12. Mainpuri	1.50	8.88	6.64	0.62	3.48	0.63	5.54	6.82	65.90 100.0
13. Mathura	0.42	1.71	7.93	0.45	1.86	0.36	2.89	2.49	81.89 100.0
14. Moradabad	2.01	2.46	7.83	0.17	2.03	0.01	2.76	1.21	81.44 100.0
15. Muzaffarnagar	1.76	2.83	11.34	0.17	1.10	0.39	1.60	1.10	79.71 100.0
16. Pilibhit	22.53	1.37	8.34	0.07	1.39	0.71	1.35	1.20	63.04 100.0
17. Rampur	2.81	3.24	9.96	0.00	0.46	0.17	1.69	0.88	80.80 100.0
18. Saharanpur	14.31	1.12	12.09	0.09	0.90	0.22	1.19	0.60	69.41 100.0
19. Shahjahanpur	2.31	2.37	8.20	0.28	1.65	1.21	5.08	2.54	76.33 100.0
Western Region	4.68	3.38	9.17	0.28	2.17	0.63	3.18	2.52	74.00 100.0

Barren and Uncultivable Land: Area under this category also shows large variations from a low 1.1 per cent to 8.9 per cent (Map VI.3). It is below 2.5 per cent in 7 districts, between 2.5 and 5.0 per cent in 8 districts and above 5.0 per cent in 4 districts. We further observe that the problem is more serious in the districts on the southern part of the region which

suffers from the problems of alkalinity and ravines to a greater extent.

Pastures and Grazing Land: Hardly any area is left under pastures and grazing land in the western districts of the state. In 6 districts less than 0.15 per cent of geographical area is under this category, while in another 7 districts it is between 0.15 to 0.30 per cent of total area. In the remaining 6 districts lying in the south-western part area under pastures and grazing land is somewhat more between 0.30 and 0.75 per cent (Map VI.4).

Culturable Wastes: By and large area under the category of culturable wastes is quite low being less than 2 per cent of geographical area in as many as 12 districts. The districts of Etawah, Farrukhabad and Mainpuri in the south-west of the region form a contiguous tract with sizeable area under culturable wastes (Map VI.5).

Area Under Trees and Groves: Area under miscellaneous tree crops and groves is also very nominal in most of the districts being less than 0.5 per cent of geographical area in as many as 12 districts and between 0.5 and 1.0 per cent of area in 4 districts. Only 3 districts (Budaun, Shahjahanpur and Farrukhabad) have more than 1 per cent area under this category. In general tree coverage slightly increases as we move from western to eastern parts of the region (Map VI.6).

Current Fallows: Area under current fallows ranges from around 1 per cent to around 6 per cent. In 6 districts less than 2 per

cent area is under current fallows, in 7 districts this figure ranges from 2 to 4 per cent while in 6 districts 4 to 6 per cent area is under this category. Three distinct spatial patterns in the extent of fallow land may be observed - districts in the northern part have low extent of fallow lands, districts on western parts fall in the middle category, while districts in eastern parts have higher extent of fallow land (Map VI.7).

Old Fallows: More or less similar geographical pattern across districts is observed in case of area under old fallows (Map VI.8). Districts on the northern side have low area under this category usually below 1.5 per cent of area. Extent of fallow lands is moderate (1.5 to 3.0 per cent) in 7 districts mostly on the western side, while a group of 4 districts (Etah, Etawah, Farrukhabad and Mainpuri) has between 3 to 7 per cent area under old fallows.

Net Sown Area: The extensive margin of cultivation has nearly reached its limit in most of the districts of the region and net sown area is the dominant land use category. In 10 districts net sown area exceeds 75 per cent of total area, while in the remaining 9 districts between 60 to 75 per cent area is under this category. The proportion of net sown area is relatively lower in the south-eastern part of the region (Map VI.9).

VI.5 District Level Trends in Land Use

Actual and per cent shift in area under different land use categories in different districts of the Western Region over the period 1968-71 and 1983-86 has been shown in Table VI.5. Table

VI.6 shows the districtwise log linear growth rates in area under different landuse categories over the period 1968-69 to 1983-86, while Table VI.7 shows the distribution of districts according to the range of growth rate of area. Brief comments on the districtwise pattern of shift in landuse as revealed by these tables are given below.

Table VI.5 : Districtwise Shifts in Land Utilization Pattern in Western Uttar Pradesh between 1968-71 and 1983-86.

(Area in Hectares)

Districts	Reporting area for land utilization		Forests		Barren and unculturable land	
	Actual	% change	Actual	% change	Actual	% change
1. Agra	-10038	-2.06	2181	5.62	-9309	-40.21
2. Aligarh	-476	-0.09	-86	-9.07	-4484	-11.93
3. Bareilly	-56	-0.01	-123	-30.00	1122	9.49
4. Bijnor	-74	-0.15	2140	5.14	-2989	-25.74
5. Budaun	-3011	-0.57	320	4.85	1418	9.45
6. Bulandshahr	-55437	-11.27	662	7.60	-7800	-33.79
7. Etah	-2026	-0.45	-1052	-48.72	-1334	-9.86
8. Etawah	-11198	-2.50	15	0.03	-16504	-32.46
9. Farrukhabad	-3596	-0.83	-1179	-21.99	-4778	-17.31
10. Ghaziabad	21336	8.97	8	0.31	-1884	-16.25
11. Meerut	32238	8.97	-25	-0.32	-1250	-16.25
12. Mainpuri	-4431	-1.01	-1727	-14.86	-27980	-42.14
13. Mathura	3821	1.02	-65	-3.94	-197	-2.96
14. Moradabad	-2752	-0.46	926	8.42	-662	-5.57
15. Muzaffarnagar	-11681	-2.72	-7223	-49.55	-1295	-9.86
16. Pilibhit	-14649	-4.02	-204	-0.29	245	5.40
17. Rampur	-1740	-0.73	-4	-0.06	1596	35.43
18. Saharanpur	752	0.15	1334	1.72	-1155	-15.78
19. Shahjahanpur	-3727	-0.80	-1900	-15.27	-893	-3.50
Western Region	-75769	-5.91	-5449	-1.35	-82429	-23.26

Table VI.5 Contd..

Districts	Land put to non-agricultural uses		Permanent pasture and other grazing land		Culturable waste	
	Actual	% change	Actual	% change	Actual	% change
1. Agra	5884	18.18	-26	-1.97	-3375	-57.59
2. Aligarh	3959	10.90	50	1.61	-2825	-23.07
3. Bareilly	4089	10.96	19	4.54	-4285	-58.16
4. Bijnor	4275	8.89	-303	-28.91	-9240	-73.24
5. Budaut	3255	8.51	-86	-10.90	-7747	-50.98
6. Bulandshahr	654	1.81	-456	-21.42	-10411	-48.83
7. Etah	6674	20.21	-15	-1.37	-11383	-23.07
8. Etawah	2570	8.36	-116	-4.86	-3251	-23.40
9. Farrukhabad	3460	9.28	32	1.03	-10069	-32.56
10. Ghaziabad	10148	41.13	192	59.03	-5427	-42.87
11. Meerut	13460	41.14	165	59.36	-3197	-42.87
12. Mainpuri	2929	11.54	350	14.94	-5094	-25.26
13. Mathura	3610	13.72	29	1.70	-423	-5.67
14. Moradabad	948	2.08	-366	-25.60	-5827	-36.34
15. Muzaffarnagar	6316	16.80	-402	-35.23	-9247	-66.67
16. Pilibhit	-1960	-6.50	-689	-69.84	-10295	-67.09
17. Rampur	2526	12.06	-8	-40.00	-3524	-76.61
18. Saharanpur	3921	6.26	-165	-24.26	-8274	-66.32
19. Shahjahanpur	2946	8.51	135	11.34	-20126	-72.63
Western Region	80153	11.91	-1605	-6.41	-140108	-44.10

Table VI.5 Contd...

Districts	Land under misc. tree crops & gro- ves in net area sown		Current fallows		Other fallow lands		Net area sown	
	Actual % change	Actual % change	Actual % change	Actual % change	Actual % change	Actual % change	Actual % change	Actual % change
1. Agra	-913	-39.80	6442	53.76	4865	73.67	-10288	2.88
2. Aligarh	-3956	-77.65	2859	26.82	2430	27.04	1477	0.37
3. Bareilly	-3820	-77.82	-4671	-22.86	2583	93.79	5529	1.53
4. Bijnor	-4967	-65.00	-15139	-73.79	-686	-20.81	19468	5.98
5. Budaun	-5518	-38.64	7519	43.38	6852	102.59	-9013	-2.19
6. Bulandshahr	-5113	-70.29	-1639	-13.57	2434	36.86	-33775	-9.01
7. Etah	-7559	-71.01	7732	47.69	18065	177.82	-13841	-4.45
8. Etawah	-1950	-58.44	5578	43.35	5785	51.32	-3204	-1.09
9. Farrukhabad	-2802	-21.11	10706	78.93	11702	112.20	-10667	-3.66
10. Ghaziabad	-1908	-63.99	613	8.67	2949	61.54	14626	8.45
11. Meerut	-739	-63.99	582	8.67	2122	61.54	24378	8.45
12. Mainpuri	-2132	-44.01	8419	54.21	17495	146.06	2713	0.96
13. Mathura	-1390	-50.92	-761	-6.55	2463	35.59	570	0.18
14. Moradabad	-4517	-66.32	-4971	-23.31	2747	62.18	9199	1.93
15. Muzaffarnagar	-3537	-68.92	-4539	-40.49	50	1.10	7696	2.36
16. Pilibhit	-7492	-75.27	-10291	-68.64	-2093	-53.42	18709	9.29
17. Rampur	-1560	-79.96	-3218	-44.79	766	59.33	1445	0.76
18. Saharanpur	-3146	-72.79	-3674	-35.94	-1354	-27.01	11599	3.13
19. Shahjahanpur	-5974	-51.89	-10243	-30.61	1721	17.31	30098	9.43
Western Region	-68991	-57.43	-8701	-3.23	80762	64.41	66224	1.10

Source: Agricultural Statistics for Uttar Pradesh (Annual)

Table VI.6 * Districtwise Log Linear Growth Rate in Area Under Different Land Use Categories in Uttar Pradesh :
1968-69 to 1985-86

(Percent per annum)

Districts	For- est	Barren & unculturable land	Land put to non-agricultural Uses	Cultu- rable waste- land	Perma- nent pastu- res other grazi- ng land	Land under misc. tree crops & gr- ow	Curr- ent fall- ow	Other fall- ow	Net down area
1. Agra	-	-	-	-	-	-	-	-	-
2. Aligarh	-0.53	-0.93	0.69	-1.69	0.06	-0.11	1.49	2.28	0.03
3. Bareilly	-2.00	0.41	0.61	-5.14	0.16	-0.12	-2.78	3.96	4.53
4. Bijnor	0.15	-1.83	0.45	-10.21	-1.47	-0.08	-10.63	-1.67	0.35
5. Budaun	0.28	0.05	0.52	-4.39	-1.33	-0.04	2.06	5.70	-0.11
6. Bulandshahr	0.49	-2.94	0.07	-5.06	-1.88	-0.09	-0.80	2.26	-0.76
7. Etah	-2.99	-0.64	1.31	-1.84	0.13	-0.09	3.51	6.80	-0.31
8. Etawah	-0.03	-3.29	0.54	-2.86	-0.49	-0.06	2.76	3.39	-0.10
9. Farrukhabad	-2.25	-1.60	0.70	-2.90	0.16	-0.02	4.53	5.37	-0.27
10. Meerut	0.14	-0.79	2.61	-4.14	3.97	-0.08	0.41	4.01	0.79
11. Mainpuri	-0.56	-3.69	0.75	-2.34	0.58	-0.04	3.42	6.55	0.06
12. Mathura	-0.18	-0.42	0.93	-0.99	0.18	-0.05	0.21	3.35	-0.02
13. Moradabad	0.49	-0.42	0.21	-3.13	-2.18	-0.08	-2.13	3.01	0.16
14. Muzaffarnagar	-21.18	-0.88	1.07	-7.81	-3.27	-0.08	-3.30	-0.47	0.19
15. Pilibhit	-0.07	0.44	-0.49	-8.07	-8.67	-0.08	-8.23	-2.47	0.62
16. Rampur	-0.08	2.08	0.58	-9.31	-4.89	-0.16	-4.54	-2.08	0.12
17. Saharanpur	0.68	-1.57	0.46	-6.56	-2.02	-0.10	-3.95	-0.72	0.25
18. Shahjahanpur	-1.03	-0.59	0.59	-8.43	0.85	-0.05	-2.39	2.50	0.57

Table VI.7 : Distribution of Districts According to Growth Rate in Area Under Different Land Use Categories in Western Uttar Pradesh - 1968-69 to 1985-86 (Nos.)

Growth Rate Per cent Per Annum	For- ests	Barren & uncultivated land	Land put to non- agri- cultural uses	Perma- nent past- ures & graz- ing land	Tree crops and groves	Cultu- rable waste land	Curr- ent fallow	Old fallow	Net sown area
<u>Negative</u>									
Upto 1.0	6	7	1	1	17	1	1	2	0
1.0 to 3.0	4	4	-	3	-	3	3	3	-
Above 3.0	1	2	-	3	-	11	5	-	-
Total	11	13	1	9	17	17	9	5	0
<u>Positive</u>									
Upto 1.0	6	3	15	7	-	-	2	-	10
1.0 to 3.0	-	1	3	-	-	-	3	3	-
Above 3.0	-	-	-	1	-	-	3	9	0
Total	6	4	18	8	-	-	8	12	10
All Districts	17	17	17	17	17	17	17	17	17

Note: Excludes Agra and Gaziabad Districts

Forests: Forest coverage which was already thin shows a further decline in as many as 11 districts of the region, most notable decline being in Muzaffarnagar district. Other 8 districts show a marginal increase in forest area.

Barren and Uncultivable Land: This category shows a marginal increase in area in 4 districts. Other districts show a decline in barren land, which was quite substantial in Mainpuri, Etawah and Agra districts.

Land Put To Non Agricultural Use: Except Pilibhit all the districts show a rise in land put to non-agricultural uses. Above average growth in this category took place in the districts of Meerut, Ghaziabad, Agra and Etah.

Pastures and Grazing Land: 11 districts have registered a decline in area under pastures and grazing land, whereas 8 districts have experienced a rise. However, actual area involved has not been more than 500 hectares in any of the districts.

Culturable Wastelands: Culturable wastelands are being increasingly reclaimed for agricultural purposes. All districts show a fairly sharp decline in culturable wastes, the decline being more than 10,000 hectares in 5 districts and between 5,000 and 10,000 in another 8 districts.

Tree Crops and Groves: Increase in the profitability of agriculture has also affected area under miscellaneous tree crops and groves which shows a clear decline in all the districts.

Current Fallows: Mixed trend is observable in case of the area under current fallows with 9 districts showing a rise and 10 districts showing a decrease in area under this category. The increase is observed mostly in the drier districts of south-west.

Other Fallows: Area under old fallows by and large shows an upward trend, except in 3 districts. The increase exceeded 5,000 hectares in 5 districts, namely, Budaula, Etah, Etawah, Farrukhabad, Mainpuri, where irrigation facilities are less developed.

Net Sown Area: Unlike in other parts of the state net sown area has shown a rising trend in West U.P. 14 districts have registered a positive trend in net sown area. The increase was more notable in the districts of Shahjahanpur, Meerut, Bijnor, Pilibhit, Ghaziabad and Saharanpur districts. On the other hand 5 districts show a decline in net sown area, namely Budaula, Bulandshahr, Etah, Etawah and Farrukhabad. Irrigation facilities again seem to be the major causal factor associated with these trends.

In interpreting the above trends we should keep in mind the fact that the total reported area has declined in as many as 15 districts the decline being sizeable in many districts. The change in the area of Bulandshahr, Ghaziabad and Meerut has been mainly due to reorganization of these districts, whereas in the case of other districts lack of coverage is possibly the main reason for the decline in reported area. A relatively better indicator of the trends in the land use pattern may be the percentage shifts in the area under different landuse categories, which have been shown in Table VI.5.

Table VI.8 : Shifts in Per cent Area Under Different Land Use Categories in West U.P. Between 1968-71 and 1983-86 in Per cent Points.

Districts	For-ests	Barren	Non-agri-cul-tural	Pastu-res	Cultu-rable waste land	Trees and groves	Curr-ent fallow	old fallow	Net sown area
1. Agra	+0.62	-1.84	+1.36	-	-1.80	-0.18	+1.41	+1.06	-0.61
2. Aligarh	-0.01	-0.88	+0.79	-	-0.55	-0.78	+0.57	+0.49	+0.37
3. Bareilly	-0.03	+0.28	+1.00	-	-1.06	-0.92	-1.14	+0.62	+1.25
4. Bijnor	+0.64	-0.57	+1.01	-0.06	-1.83	-0.98	-3.02	-0.12	+4.97
5. Budaun	+0.07	+0.29	+0.66	-0.02	-1.42	-1.03	+1.46	+1.33	-1.26
6. Bulandshahr	+0.38	-1.19	+1.08	-0.06	-1.88	-0.98	-0.05	-0.73	+1.93
7. Etah	-0.23	-0.28	+1.53	-0.01	-2.37	-1.68	+1.77	+4.08	-2.81
8. Etawah	+0.24	-3.54	+0.75	-0.01	-0.67	-0.42	+1.36	+1.39	+0.94
9. Farrukhabad	-0.26	-1.06	+0.87	+0.01	-2.34	-0.63	+2.54	+2.76	-1.93
10. Ghaziabad	-0.10	-1.13	+3.06	+0.06	-2.54	-0.85	-0.01	+0.97	+0.54
11. Meerut	-0.19	-0.49	+2.68	+0.03	-0.99	-0.22	-0.01	+0.46	-1.27
12. Mainpuri	-0.23	-6.30	+0.73	+0.09	-1.13	-0.48	+1.99	+4.08	+1.28
13. Mathura	-0.02	-0.07	+0.87	-0.06	-0.14	-0.37	-0.22	+0.64	-0.68
14. Moradabad	+0.17	-0.13	+0.19	-0.07	-0.67	-1.13	-0.81	+0.47	+1.92
15. Muzaffarnagar	-1.63	-0.22	+1.90	-0.09	-2.13	-0.80	-1.01	+0.09	+8.96
16. Pilibhit	+0.84	+0.13	-0.21	-0.18	-2.94	-2.03	-2.77	-0.52	+7.69
17. Rampur	+0.02	+0.87	+1.13	-0.01	-1.51	-0.65	-1.34	+0.34	+1.21
18. Saharanpur	+0.23	-0.21	+0.69	-0.03	-1.32	-0.57	-0.67	-0.31	+2.32
19. Shahjahanpur	-0.39	-0.06	+0.70	+0.02	-4.36	-1.29	-2.18	+0.38	+7.14
Western U.P.	-0.02	-0.90	+1.04	-0.02	-1.66	-0.82	-0.07	+1.01	+1.47

Source: Calculated from Agricultural Statistics for U.P. (Annual)

By and large we find a similarity of changes in landuse pattern across districts though the proportion of area affected varies significantly. Thus, per cent of area under the categories barren and non-cultivable area, forests, pastures, culturable wastes, trees and groves shows a negative shift and area under non-agricultural uses and old fallows shows a positive shift in

the majority of districts. With respect to the other two categories, i.e., current fallows and net sown area the shifts present a mixed picture. Thus 5 districts show negative shift in current fallows. Similarly, 13 districts show a positive shift and 6 districts a negative shift in net sown area. In many of the districts the shifts in these two categories are in the opposite direction suggesting that either current fallows have been brought under net sown area or vice versa. But in Meerut and Mathura district we find that both these categories are losing area in favour of other categories. In Agra, Budoun, Etah and Farrukhabad, where irrigation facilities are less developed, area shifts have taken place against net sown area and in favour of current fallows. Largest gains in per cent area under cultivation have taken place in Shahjahanpur, Pilibhit, Bijnor and Muzaffarnagar district. The gain in net sown area in these districts has been at the cost of area under categories like forests, culturable wastes, trees and groves and current fallows.

In large parts of the region the land use pattern shows a fair degree of stability over time. Thus in as many as 12 districts less than 5 per cent of reported area was involved in a shift from one use to another. However, in 7 districts on the northern and eastern fringe of the region shifts in land use were more pronounced. The group of districts comprising Muzaffarnagar, Bijnor, Pilibhit, Mainpuri and Shahjahanpur is characterized by an expansion in cultivated area largely at the cost of culturable wastes and current fallows. In these districts expansion of irrigation has helped in a more intensive land use. However, in

Etah and Farrukhabad area has shifted from cultivation to categories like fallow land.

VI.6 Conclusion

The study of landuse pattern in western Region reveals important imbalances requiring immediate attention of the planners. Cultivation is the dominant land use category covering nearly three fourths of the geographical area. What is a matter of serious concern is the extremely low green cover in the region. Except in the districts of Agra, Bijnor, Etawah, Pilibhit and Saharanpur the forest cover has nearly vanished as also area under pastures and grazing land or area under tree crops and groves. Thus green cover is much below the recommended norm of 20 per cent of total area in the plains for ecological balance. Though the intensity of landuse is quite high, over 10 per cent of the area is under fallows, culturable wastes and non-culturable wastes, which could be put to better use.

There are noticeable differences in landuse pattern within the region. Broadly we find that in the northern part of the region intensity of landuse is higher and the percentage of area under crop cultivation is larger. In the southern parts, however, area under crop cultivation is relatively lower but area under categories like fallow land and wastelands is larger. These differences in the landuse pattern seem to be related to agro-climatic conditions and availability of irrigation facilities and soil conditions.

The study of the trends in land use over time reveals that area under non-agricultural uses is steadily but slowly increasing. The green cover which is extremely inadequate has further shrunk which is reflected in a decline in area under forests, pastures, tree crops and groves. Area under cultivable and non-cultivable wasteland has shown a steady and marked decline. The extensive margin of cultivation has further expanded in the region unlike in other parts. Current fallows, however, show a rise, though old fallows have declined.

While there is a broad similarity in the trends in land use across districts some differences in the pattern of shift are noticeable particularly with respect to the current and old fallows and net sown area. Again a north south divide in the pattern of change is observed. While most of the districts in the northern part of the region have witnessed an expansion of net sown area at the cost of cultivable wasteland and current fallows, a group of districts in the southern part comprising the districts of Agra, Budaun, Etah, Farrukhabad and Mathura has experienced a negative shift in net sown area. Expansion of irrigation facilities in these districts will help in a better and more intensive land use pattern.

CHAPTER VII

CROPPING INTENSITY AND CROPPING PATTERN

VII.1 Cultivable Area and Its Exploitation

Soil, water and other agro-climatic conditions in Western U.P. are highly favourable for agriculture. Potentially about 83 per cent of the area in the region can be brought under cultivation. At the district level cultivable area ranges from 67 per cent to 89 per cent as shown in Table VII.1 and Map VII.1. However, nearly 90 per cent of the cultivable area has already been brought under the plough. As can be seen from Table VII.1 and Map VII.2 in most of the district the margin of cultivation has been almost fully exhausted. From the point of view of environmental balance it would not be desirable to extend area under cultivation, which has already reached the figure of nearly 75 per cent of reported area. In fact effort should be made to shift cultivated area, particularly on marginal lands, to other uses like tree plantations. In some districts in the south eastern part of the region, e.g., Etah, Mainpuri and Farrukhabad net sown area can be expanded to some extent if irrigation facilities are developed. In other districts efforts should be made to reduce fallow lands to the extent possible.

Table VII.1 : Cultivable Area and Its Utilization in Western U.P., 1983-86

District	Cultivable Area As Per cent of Reported Area	Cultivated Area As Per cent of Cultivable Area
Agra	80.21	90.5
Aligarh	84.51	92.0
Bareilly	86.22	94.6
Bijnor	72.67	96.8
Budaun	85.75	89.7
Bulandshahr	85.06	91.8
Etah	87.14	76.5
Etawah	76.71	86.2
Farrukhabad	81.17	80.6
Ghaziabad	81.21	89.2
Meerut	84.30	94.9
Mainpuri	81.74	80.6
Mathura	89.12	91.9
Moradabad	87.13	93.6
Muzaffarnagar	83.51	95.4
Pilibhit	66.97	94.1
Rampur	83.81	96.4
Saharanpur	72.17	96.2
Shahjahanpur	85.62	89.1
Western U.P.	83.20	89.0

Source: Calculated from Bulletin of Agricultural Statistics, U.P.

VII.2 Intensity of Cropping

Future expansion in agricultural output has to be obtained mainly by increasing the intensity and efficiency of cultivation. Cropping intensity (i.e., the ratio of gross sown area to net sown area) in the region has gone up from 136.4 in 1968-71 to 153.6 in 1983-86. Double cropped area shows a distinct rise over this period in all the districts of the region (Table VII.2).

Significant variations in the intensity of cropping continue to exist across districts. The figure is below 145 in 4 districts, between 145 and 155 in 6 districts and between 155 and 175 in 9 districts. As can be seen from Map VII.3 the intensity of cultivation is distinctly higher in the districts on the western border of the region, which have more developed irrigation facilities.

Though intensity of cropping is relatively high in the region as compared to other parts of the state and the country, there is still a good scope of raising intensity of cropping particularly in the lagging districts by expanding the irrigation facilities. Target of cropping intensity should be kept at atleast 200 for the region as a whole, which would mean bringing about 30 lakh hectares of additional area under double cropping.

Table VII.2 : Districtwise Cropping Intensity in Western Uttar Pradesh

District	1968-71	1983-86	Change in % points
Agra	122.4	134.4	12.0
Aligarh	149.5	165.4	15.9
Bareilly	131.9	150.1	18.2
Bijnor	126.8	137.8	11.0
Budaun	124.3	141.8	17.5
Bulandshahr	149.1	172.7	23.7
Etah	141.5	160.6	19.1
Etawah	132.8	145.3	12.5
Farrukhabad	131.6	149.3	17.7
Ghaziabad	151.3	167.8	16.5
Meerut	147.8	164.1	16.4
Mainpuri	137.4	152.6	15.2
Mathura	128.4	140.1	11.7
Moradabad	130.1	152.9	22.8
Muzaffarnagar	142.8	160.0	17.1
Pilibhit	138.5	164.9	26.3
Rampur	142.6	162.3	19.6
Saharanpur	144.6	162.0	17.4
Shahjahanpur	129.8	147.9	18.1
Western U.P.	136.4	153.6	17.3

Source: Calculated from Bulletin of Agricultural Statistics, U.P.

VII.3 Cropping Pattern

Cropping pattern in the Western Region is more diversified than in other parts of the state. Thus foodgrains account for 64.0 per cent of gross cropped area in West U.P. as compared to 70.2 per cent area in U.P. as a whole (Table VII.3). Wheat crop dominates the cropping pattern of the region with 34.3 per cent area under the crop. Rice accounts for 12.2 per cent of the cropped area. Among coarse cereals bajra and maize are relatively more important, each accounting for around 7 per cent of the gross cropped area. Pulses area grown only over 6.9 per cent of area.

Western U.P. is a major sugarcane growing area in the country, with about 12 per cent of the gross cropped area under the crop. Oilseeds are grown over 4.3 per cent area with rapeseed and mustard as the major oilseed crop. The region also specialises in the cultivation of a large variety of vegetables. Mango is the main foodcrop in the region.

Important variations in the cropping pattern exist at the district level, which merit further examination. Thus, per cent of area under foodgrains varies from 45 per cent to as much as 85 per cent. In general the proportion of area under foodgrains rise as we move from north to south. (Table VII.4 and Map VII.4). The most commercialized zone of the region consists of the districts of Saharanpur, Muzaffarnagar, Meerut and Bijnor districts with around half of the cultivated area under foodgrains. On the other hand in 8 districts 60 to 80 per

Table VII.3 : Cropping Pattern in Western U.P. (Average For 1983-84, 1984-85 and 1985-86)

Crop	Area in lakh ha.		Per cent of Gross Cropped area	
	West U.P.	Uttar Pradesh	West U.P.	Uttar Pradesh
Rice	11.39 (20.8)	54.82	12.2	24.8
Wheat	32.00 (38.1)	83.92	34.3	33.3
Jowar	1.06 (16.4)	6.45	1.1	2.6
Bajra	7.05 (74.2)	9.50	7.6	3.8
Maize	6.03 (31.8)	11.65	6.5	4.8
Barley	2.19 (37.1)	5.90	2.4	2.3
Small Millets	0.02 (0.3)	4.18	-	1.7
<u>Total Cereals</u>	<u>59.69 (33.8)</u>	<u>176.55</u>	<u>64.0</u>	<u>70.2</u>
Gram	2.17 (15.2)	14.24	2.3	3.7
Arhar	1.1 (19.2)	5.26	1.1	2.1
<u>Total Pulses</u>	<u>6.49 (21.9)</u>	<u>29.64</u>	<u>6.9</u>	<u>11.8</u>
<u>Total Foodgrains</u>	<u>66.16 (32.1)</u>	<u>206.18</u>	<u>70.9</u>	<u>81.9</u>
Total Oilseeds	4.02 (47.9)	8.40	4.3	3.3
Ground Nut	0.76 (42.0)	1.81	0.8	0.7
Rapeseed and Mustard	3.03 (62.3)	4.86	3.3	1.9
Sugarcane	10.24 (65.1)	15.73	12.3	6.3
Potato	1.50 (48.4)	3.10	1.6	1.2
Cotton	0.26 (100.0)	0.26	0.3	0.1
Other Crops	11.14 (62.1)	17.93	11.1	7.1
<u>Total Non-Foodgrains</u>	<u>27.16 (57.8)</u>	<u>45.42</u>	<u>29.1</u>	<u>18.1</u>
<u>Total Cropped Area</u>	<u>93.32 (37.1)</u>	<u>251.60</u>	<u>100.0</u>	<u>100.0</u>

Source: Calculated from Bulletin of Agricultural Statistics, U.P.

cent area is under foodgrains. The figure exceeds 60 per cent in 7 districts mostly in the middle and southern parts of the region.

In all except three districts wheat is the first major crop with around 30 to 40 per cent of the cropped area under the crop (Map VII.5). Paddy cultivation is relatively more significant in 8 districts on the northern Ganga belt and in Etawah and Mainpuri on the southern side (Map VII.6).

The districts specializing in the production of coarse cereals particularly maize and bajra are Agra, Aligarh, Budaun, Bulandshahr, Etah, Etawah, Farrukhabad, Mainpuri and Mathura with over one-fourth of cropped area under coarse cereals. Agra, Aligarh, Etah and Etawah also specialise in pulse cultivation.

Major concentration of sugarcane is found in the districts of Ghaziabad, Muzaffarnagar, Bijnor, Rampur and Mathura. Agra and Mathura are specialising in cultivation of oilseeds to a greater extent.

On the basis of the study of the proportion of area under first three major crops in a district we have identified four crop zones in Western U.P.: (i) wheat, rice, sugarcane zone; (ii) wheat, coarse grains, oilseeds zone; (iii) wheat, maize, sugarcane zone; and (iv) wheat, coarse grains, rice zone. Districts falling in each crop zone have been indicated in Table VII.4. It will be observed that each crop zone constitutes a distinct spatial cluster of districts, which are formed by the agro-climatic conditions like water, soil, climate, rainfall, etc.

Table VII.4 : Districtwise Per Cent Area Under Major Crops:
U.P., 1983-84

Districts	Wheat	Rice	Coarse Cereals	Pulses	Total Food- grains	Sugar Cane	Oilseeds
Agra	28.7	0.5	31.2	12.8	73.2	0.4	16.0
Aligarh	34.1	2.3	31.6	13.6	81.6	2.2	5.7
Bareilly	32.6	27.1	9.0	7.7	76.4	3.1	4.6
Bijnor	28.5	17.5	1.0	3.0	50.0	29.8	3.3
Budaun	37.5	8.0	28.3	6.9	82.7	3.1	6.3
Bulandshahr	37.3	1.4	29.9	4.2	72.9	6.8	2.7
Etah	35.3	5.7	30.4	13.7	85.1	1.5	4.0
Etawah	28.6	17.5	24.5	15.1	85.7	1.5	5.6
Farrukhabad	31.5	8.2	28.6	5.2	73.5	2.2	4.2
Ghaziabad	34.9	2.6	18.7	4.0	60.2	9.7	1.1
Meerut	32.6	3.4	6.9	2.4	45.3	46.6	0.8
Mainpuri	36.4	14.4	26.6	7.4	84.8	0.5	4.6
Mathura	40.8	1.2	24.3	8.0	74.3	3.1	9.7
Moradabad	36.7	14.5	13.1	2.2	66.5	17.0	2.0
Muzaffar- nagar	30.3	8.5	3.1	2.3	44.2	33.6	0.7
Pilibhit	37.7	37.4	1.1	4.8	81.0	8.2	5.3
Rampur	35.9	22.7	8.9	3.3	70.8	8.0	2.1
Saharanpur	31.3	15.8	5.2	2.4	54.7	21.2	2.9
Shahjahan- pur	40.2	28.5	6.3	9.0	84.0	5.2	3.2
Western U.P	34.3	12.2	17.5	6.9	70.9	12.5	4.3

Source: Calculated from Bulletin of Agricultural Statistics, U.P.

Table VII.5 : Cropping Zones In Western U.P.

Crop Zone	Districts Included
I. Wheat, Rice, Sugarcane Zone	Bareilly, Sitapur, Moradabad, Muzaffarnagar, Pilibhit, Rampur, Saharanpur, Shahjahanpur
II. Wheat, Coarse Cereals, Oilseeds Zone	Agra, Aligarh, Mathura
III. Wheat, Maize, Sugarcane Zone	Bulandshahr, Ghaziabad, Meerut
IV. Wheat, Coarse Cereals, Rice Zone	Budaun, Etah, Etawah, Farrukh- abad, Mainpuri

VII.4 Shifts In The Cropping Pattern

Cropping pattern of a region undergoes changes with changes in technology and economic factors. Important changes have taken place in the cropping pattern of Western U.P. and the State in the wake of the green revolution. Wheat and rice area has gone up substantially in absolute and relative terms at the cost of area under inferior cereals and pulses (Table VII.6). These changes have important implication for the nutritional balance as well as availability of fodder for the livestock. Bulk of gain in wheat and rice area took place in the early phase of the green revolution.

An important feature of the shifts in the cropping pattern has been the relatively faster expansion of commercial crops particularly sugarcane and rapeseed and mustard. In fact the proportion of area under non-foodgrains has registered a jump

Table VII.6 : Shifts In Cropping Pattern In West U.P.
1948 to 1986

Crop	Area in lakh ha.			% of Gross Cropped Area		
	1948-71	1983-86	Actual change	1948-71	1983-86	Actual change
Rice	8.93	11.39	+2.46	10.9	12.2	+ 1.3
Wheat	24.08	32.00	+7.92	29.4	34.3	+ 4.9
Jowar	1.74	1.06	-0.68	2.1	1.1	- 1.0
Bajra	7.31	7.05	-0.45	9.2	7.6	- 1.6
Maize	6.92	6.03	-0.89	8.5	6.5	- 2.0
Barley	2.48	2.19	-0.29	3.0	2.4	- 0.6
Total Cereals	51.70	59.69	+7.99	63.1	64.0	+ 0.9
Gram	3.66	2.17	-3.49	4.9	2.3	- 4.6
Arhar	1.46	1.01	-0.45	1.8	1.1	- 0.7
Total pulses	11.14	6.47	-4.65	13.6	6.9	- 6.7
Total Foodgrains	62.85	66.16	+3.31	76.7	70.9	- 5.8
Total Oilseeds	2.61	4.02	+1.41	3.2	4.8	+ 1.6
Ground Nut	1.86	0.76	-1.10	2.3	0.9	- 1.5
Rapeseed & Mustard	0.70	3.03	+2.33	0.9	3.3	+ 2.4
Sugarcane	7.59	10.24	+2.65	9.3	12.5	+ 3.2
Potato	0.69	1.30	+0.61	0.9	1.6	+ 0.7
Cotton	0.50	0.23	-0.24	0.6	0.3	- 0.3
Other Crops	7.68	7.35	-0.33	9.3	11.1	+ 1.8
Total Non-Foodgrains	19.07	27.16	+8.09	23.3	29.1	+ 5.8
Total cropped area	81.92	93.32	+11.40	100.0	100.0	--

Source: Calculated from Bulletin of Agricultural Statistics, U.P.

Table VII.7 : District Level Shifts in the Cropping Pattern in U.P. Between 1965-71 and 1983-84

District	Shift in % Area Under the Crop in % Points					
	Rice	Maize	Wheat	Gram	Oilseeds	Sugarcane
Agra	-0.1	-0.9	1.7	-3.5	11.4	-0.6
Aligarh	-0.5	-4.6	3.4	-3.0	3.2	-1.3
Bareilly	3.7	-2.1	7.2	-6.6	-1.5	-1.0
Bijnor	-5.5	-2.3	1.6	-5.5	-0.6	11.2
Budaun	1.4	-1.0	7.5	-3.5	-2.9	-1.6
Bulandshahr	-0.7	2.9	2.2	-3.5	2.4	0.5
Etah	0.3	-3.6	7.1	-2.3	-0.4	-0.8
Etawah	3.0	-2.5	4.7	-2.6	1.6	-0.5
Farrukhabad	1.5	0.5	3.7	-3.8	-1.5	0.1
Ghaziabad	-1.9	-0.9	3.5	-3.2	1.0	2.6
Meerut	-1.4	-1.6	1.9	-3.3	0.8	17.0
Mainpuri	1.8	-3.3	7.9	-4.6	1.1	-0.6
Mathura	-0.1	-1.6	6.4	-6.3	2.4	-1.5
Moradabad	0.2	-1.8	2.8	-3.7	-2.5	7.2
Muzaffarnagar	-0.8	-2.7	-0.4	-2.3	0.6	7.2
Pilibhit	5.2	-1.3	11.1	-6.4	0.7	-5.1
Rampur	9.2	-7.2	7.4	-8.1	-	0.7
Saharanpur	-0.8	-2.4	2.5	-4.3	0.6	4.7
Shahjahanpur	3.9	-1.2	12.5	-6.2	-1.0	-2.5
Western U.P.	1.3	-2.0	4.9	4.6	1.1	3.0

Source: Calculated from Bulletin of Agricultural Statistics, U.P.

from 23.3 per cent to 29.4 per cent. This has been made possible by the expansion of the double cropped area, bulk of which has gone to the non-foodgrain crops.

District level changes in the cropping pattern have been shown in Table VII.7. Proportion of gross cropped area under wheat has gone up in all the districts of the region except Muzaffarnagar. Major expansion of area under wheat has taken place in the districts of Shahjahanpur, Pilibhit, Rampur, Budaun, Bareilly, Mainpuri and Mathura all of which registered gains of 5 per cent point or more. Major expansion in rice area has occurred in Bareilly, Etawah, Pilibhit, Rampur and Shahjahanpur districts. On the other hand in as many as 9 districts per cent area under rice has declined. Maize and gram area shows a decline in almost all districts.

The pattern of shift has been somewhat mixed in the case of commercial crops. Thus a number of districts show decline in per cent area under oilseeds and sugarcane. On the other hand notable gains have been registered in oilseed area in the districts of Agra, Aligarh and Mathura and in sugarcane area in the districts of Bijnor, Meerut, Moradabad, Muzaffarnagar and Baharanpur.

VII.5 Conclusion

In most parts of the region the limits of extensive cultivation have been reached and a very high proportion of area has been brought under cultivation. It would be desirable, therefore, to shift some of the cultivated area to orchards and tree farming. In some districts in the north eastern part of the region like Etah, Mainpuri and Farrukhabad it may be possible to expand net sown area by reducing area under current and old fallows through expansion of irrigation facilities. There is also a good scope of raising the intensity of cropping particularly in the lagging districts by expanding irrigation and introducing quick maturing crops.

The cropping pattern in the region is well diversified. The major specialisation of the region is in wheat, sugarcane, rice, coarse cereals and oilseeds. We have also identified four distinct cropping zones reflecting the variations in the agro-climatic conditions. Major shifts in the cropping pattern have taken place in favour of wheat, sugarcane and rice at the cost of coarse cereals and pulses.

Though the region has comparative advantage in growing wheat and rice further expansion of area under these crops would not be desirable to maintain diversity and balance in the cropping pattern. However, there is further scope for expanding area under commercial crops like sugarcane, rapeseed and mustard and vegetables. Similarly emphasis is required on horticulture and agro-forestry to expand tree coverage and check wind

erosion. Cultivation of fodder crops like maize, bajra, legumes and barseem should be promoted to reduce the shortage of green fodder.

It should be possible to bring in more area under these crops without a decline in area under cereals through expansion of double cropped area. This would require expansion of irrigation facilities on the one hand and emphasis on developing high yielding and quick maturing varieties of sugarcane, oilseeds, pulses and other crops. Agricultural research and extension systems have to be appropriately geared to achieve these objectives.

CHAPTER VIII

IRRIGATION AND WATER RESOURCES

VII.1 Introduction

Land and water resources are interrelated in a dynamic natural setting. The problems of deforestation, soil erosion, sedimentation of reservoirs, floods, waterlogging and soil salinity are closely related. Availability of irrigation facilities affects the pattern, intensity and efficiency of land use. It is only by maintaining a proper balance between the land and water regimes that we can hope for a sustainable process of development. This calls for an integrated strategy of land and water resource development.

The demand for water resources is likely to shoot up rapidly in the coming decades both for agricultural and non-agricultural uses. National Commission On Agriculture has estimated that at the national level the demand for water resources would go up by about 175 per cent between 1973-74 and 2025 AD. - from 38 Mham to 105 Mham. In other words demand for water would rise at the rate of 2 per cent per annum. According to another study the demand for water is projected to rise by 350 per cent between 1968 and 2000 AD in U.P. - from 4 Mham to 18 Mham. This implies an increase of 4.7 per cent per annum. This underscores the need for efficient and proper management of our water resources.

VIII.2 Irrigation Trends and Sources

During the British rule heavy investment was made in developing the canal network which particularly benefited western region of U.P., suffering from scantier rainfall resulting in occasional droughts. This laid the foundation for agricultural growth in the region. After Independence too heavy investment was made by the state government to develop irrigation facilities. Farmers also invested heavily in the development of groundwater. Consequently, area irrigated has expanded very substantially in the region as in other parts of the state. Thus, about 25 lakh hectare of additional area has been brought under irrigation over 1953-56 and 1983-86 (Table VIII.1).

Table VIII.1 : Growth of Net and Gross Irrigated Area in West U.P.

Period	Net Irrigated Area		Gross Irrigated Area		Irrigation Intensity
	Actual ('000 ha.)	As % of N.S.A.	Actual ('000 ha.)	As % of G.S.A.	
1953-56	2425 (100.0)	35.9 (100.0)	2447 (100.0)	33.5 (100.0)	115.2 (100.0)
1968-71	3220 (131.5)	53.6 (149.3)	3980 (162.5)	48.6 (145.1)	123.6 (107.3)
1983-86	4673 (219.9)	77.0 (214)	6161 (251.6)	66.0 (19.7)	131.5 (114.4)

Source : Calculated from Bulletin of Agricultural Statistics, U.P.

Note : Figures in parentheses show index with 1953-56 = 100.

Though irrigation facilities are relatively well developed in the region considerable variations in the coverage of irrigation exists at the district level - from 60 per cent to 96.7 per cent of net sown area (Table VIII.2). The most developed tract from the point of view of irrigation lies on the western border covering the districts of Meerut, Ghaziabad, Bulandshahr and Aligarh with over 90 per cent of irrigation coverage (Map VIII.1). The districts of Muzaffarnagar, Mathura, Mainpuri and Etah also have 80 to 90 per cent area under

Table VIII.2 : Districtwise Net And Gross Irrigated Area In West U.P., 1983-86

District	Net Irrigated Area As Per cent of Net Sown Area	Gross Irrigated Area As Per cent of Gross Sown Area
Agra	63.8	52.2
Aligarh	93.3	72.7
Bareilly	61.4	46.7
Bijnor	61.2	55.7
Budaun	59.7	45.7
Bulandshahr	96.7	86.9
Etah	82.4	60.7
Etawah	68.4	61.4
Farrukhabad	67.1	52.3
Ghaziabad	92.1	68.2
Meerut	95.0	71.3
Mainpuri	83.7	64.9
Mathura	84.0	67.8
Moradabad	79.4	63.4
Muzaffarnagar	88.2	61.2
Pilibhit	78.0	67.1
Rampur	73.2	62.9
Saharanpur	73.5	66.7
Shahjahanpur	62.3	62.6
West U.P.	77.0	66.0

Source : Calculated from Bulletin of Agricultural Statistics, U.P.

irrigation. On the other hand in 4 districts 70 to 80 per cent area receives irrigation while in 7 districts this proportion is between 60 and 70 per cent.

Similar variations in the coverage of gross irrigated area across districts can be observed from Table VIII.2 and Map VIII.1.

These lagging districts should receive special attention in future strategy of irrigation development. It may be added here that in these districts the proportion of net sown area is lower and considerable part is under wastelands.

Major changes have taken place in the sources of irrigation. In the early fifties over half of the area was irrigated by canals but now canals account for only 26.6 per cent of the irrigated area (Table VIII.3). Tubewells now account for 63 per cent of the irrigated area, whereas at the state level this proportion is around 57 per cent. Only about 10 per cent of area is irrigated by tanks, ponds, other wells, etc. Thus, not only the irrigation coverage has expanded substantially in the region, the reliability and efficiency of irrigation in terms of sources has also improved.

At the district level the relative importance of different sources shows clear variations as can be seen from Table VIII.4. Tubewells are now the dominating source of irrigation in all district except Etawah. Tubewells account for 50 to 70 per cent of irrigated area in 9 districts and over 70 per cent in another 9 districts.

Table VIII.3 : Growth of Irrigated Area By Sources In west U.P.

('000 ha.)

Source	1953-56	1968-74	1983-86
Canals	1099 (51.7)	1489 (36.9)	1245 (26.6)
Tubewells :		1205 (37.4)	2946 (63.0)
Other wells :	969 (45.6)	761 (23.7)	340 (7.3)
Other sources	57 (2.6)	64 (2.0)	142 (3.0)
All Sources	2125 (100.0)	3219 (100.0)	4673 (100.0)

Source: Calculated from Bulletin of Agricultural Statistics, U.P.

The number of tubewells and pumpsets per 1000 ha. of net sown area varies from 87 to 186 (Table VIII.4). The concentration of tubewells is relatively heavier in the districts on the north-western part of the region as compared to the south-eastern part (Map VIII.3).

The canal network is of relatively low importance in the districts of Bijnor, Budaun, Moradabad, Farrukhabad, Rampur and Shahjahanpur, where less than 15 per cent area is irrigated by canals. In the districts of Agra, Aligarh, Bulandshahr and Etah between 15 to 20 per cent of area is irrigated by canals. In the remaining districts (Bareilly, Ghaziabad, Meerut, Mainpuri, Mathura, Muzaffarnagar, Pilibhit, Sanatanpur and Etawah) canals account for over 25 per cent of irrigated area. These districts provide a good example of constructive use of surface and ground water and have a relatively higher coverage of irrigation facilities.

Table VIII.4 : Districtwise Area Irrigated By Different Sources
As Per cent of Net Irrigated Area in West U.P.,
1987-88.

District	Canals	Tubewells	Other Sources	All Sources	Tubewells & Pumpssets Per 1000 ha. 1984-85
Agra	16.4	80.9	2.7	100.0	181
Aligarh	20.5	78.6	0.9	100.0	127
Bareilly	27.5	51.3	21.2	100.0	87
Bijnor	4.7	76.4	18.9	100.0	145
Budaun	0.1	61.7	38.2	100.0	80
Bulandshahr	19.4	74.8	5.8	100.0	152
Etah	22.4	66.5	11.1	100.0	103
Etawah	58.3	37.5	4.2	100.0	89
Farrukhabad	11.5	83.6	4.9	100.0	147
Ghaziabad	31.7	59.2	9.1	100.0	163
Meerut	26.4	72.6	1.0	100.0	163
Mainpuri	27.9	70.3	1.8	100.0	137
Mathura	39.3	59.9	0.8	100.0	109
Moradabad	3.2	73.2	23.6	100.0	186
Muzaffarnagar	38.6	60.5	0.9	100.0	160
Pilibhit	33.1	55.0	11.9	100.0	122
Rampur	15.8	69.1	15.1	100.0	139
Saharanpur	31.5	67.4	1.1	100.0	163
Shahjahanpur	12.9	80.9	6.2	100.0	112
West U.P.	22.5	68.5	9.0	100.0	133

Source : Calculated from Bulletin of Agricultural Statistics, U.P.

In the districts of Bareilly, Budaun, Bijnor, Moradabad, Pilibhit and Rampur, most of which lie in the northern canal other sources like ponds, jills and wells are still an important source of irrigation. But in other districts these sources are now of minor importance.

Looking at the cropwise pattern of irrigation we find distinct preferences of the farmers (Table VIII.5). Thus kharif

Table VIII.5 : Cropwise Irrigated Area In West U.P., 1987-88

Crop	Irrigated Area ('000 ha.)	As Per cent of Area Under The Crop	As Per cent of Total Irrigat- ed Area
Rice	769	87.7	10.9
Jowar	9	9.5	0.1
Bajra	89	15.8	1.3
Maize	372	65.5	5.3
Wheat	3056	96.8	43.3
Barley	174	85.7	2.5
Pulses	331	56.4	4.7
Kharif Foodgrains	1243	57.8	17.6
Rabi Foodgrains	3450	90.9	48.9
Total Foodgrains	4805	79.2	68.1
Oilseeds	283	66.3	4.0
Sugarcane	1084	91.9	15.3
Other Crops	387	67.7	12.5
All Crops	7056	78.6	100.0

Source: Calculated from Bulletin of Agricultural Statistics,
U.P., 1987-88

foodgrains are nearly wholly under irrigated conditions while only 58 per cent of Kharif foodgrains receive irrigation. Among foodgrains 85 per cent and above area is covered by irrigation in case of wheat rice and barley. But in case of pulses only 56 per cent area is irrigated. Among commercial crops the proportion of irrigated area is 91.9 per cent in case of

sugarcane and only 66.3 per cent in case of oilseeds. Wheat alone accounts for 43.3 per cent of total irrigated area, sugarcane for 15.3 per cent and rice for 10.9 per cent of the irrigated area. Since the water is available in the region development of water and fertiliser responsive varieties of pulses, oilseeds and coarse cereals should receive attention of the agricultural scientists.

VIII.3 : Surface Water Potential and Exploitation

Western Region of U.P. which falls in the Ganga basin is rich in surface water resources. The major rivers flowing through the region (e.g., Ganga, Yamuna and Ramganga) are perennial streams originating in the mighty Himalayas. The canal network in the region is over a century old and has contributed to the agricultural prosperity of the region.

The utilizable water potential in the state has been estimated at 161.64 Maf. by the Irrigation Department, U.P. out of which the share of the rivers passing through the region comes to 79.06 Maf. - Ganga, 32 Maf.; Yamuna, 26.04 Maf.; Ramganga, 13.10 Maf. and Chambal, 7.92 Maf.

According to the current estimates of the Ministry of Agriculture, Government of India the estimated irrigation potential in U.P. from major and medium projects is 125 lakh hectares. Against this a potential of 68 lakh ha. had been created by 1984-85, which comes to about 55 per cent of the

ultimate potential. Clearly there is a good scope for expanding surface irrigation facilities in the state as well as in the Western Region.

Out of the estimated irrigation potential of surface water of 124.18 lakh ha. in U.P. the share of West U.P. comes to 39.84 lakh ha. or 32 per cent. Around 40 per cent of the ultimate potential in the region is still to be exploited, which will raise the irrigation potential of surface water in the region to 65 per cent of net sown area. Districtwise potential of surface water and its exploitation in the Western Region has been shown in Table VIII.6. The potential of surface water as per cent of net sown area is relatively low in the districts of Budaun, Farrukhabad and Moradabad. In other districts of the region there is a sizeable potential of surface water. The degree of present exploitation shows large variations across districts -- from only 1.4 per cent to 87.9 per cent (Table VIII.6).

It is anticipated that at the end of the ongoing schemes an additional irrigation potential of 16.5 lakh ha. will be created in the region. In 5 districts unexploited potential exceeds 1 lakh ha., in 7 districts it is between 0.50 to 1.00 lakh ha. and in 7 districts below 0.50 lakh ha. The major ongoing schemes and their balance potential has been shown in Table VIII.7.

Table VIII.6 : Districtwise Surface Water Potential of the Continuing Schemes in West U.P. (1000 hectares)

District	Final Anticipated Potential	Potential As % of Net Sown Area	Anticipated Potential Created by 1985	Potential to be created
Agra	330	93.1	128 (38.8)	202 (61.2)
Aligarh	324	83.3	177 (54.3)	147 (45.7)
Bareilly	182	54.3	144 (79.1)	38 (20.9)
Bijnor	204	58.5	75 (36.6)	129 (61.4)
Budaun	71	17.7	1 (1.4)	70 (98.6)
Bulandshahr	259	76.7	170 (65.6)	89 (34.4)
Etah	168	54.5	127 (75.6)	41 (24.4)
Etawah	294	100.0	201 (68.4)	93 (31.6)
Farrukhabad	103	33.8	77 (74.8)	26 (25.2)
Ghaziabad	107	56.0	94 (87.9)	13 (12.1)
Meerut	270	86.0	163 (60.4)	107 (39.6)
Mainpuri	199	69.1	133 (76.9)	46 (23.1)
Mathura	433	143.5	205 (47.3)	228 (52.7)
Moradabad	133	28.2	50 (37.6)	83 (62.4)
Muzaffarnagar	287	86.0	189 (65.9)	98 (34.1)
Pilibhit	129	59.6	25 (65.9)	44 (34.1)
Rampur	112	60.2	87 (77.7)	25 (22.3)
Saharanpur	191	50.1	122 (63.9)	69 (36.1)
Shahjahanpur	184	53.1	89 (48.4)	95 (51.6)
West U.P.	3984	65.4	2336 (58.7)	1648 (41.3)
Uttar Pradesh	12418	71.0	7425 (59.8)	4993

Source: Irrigation Department, U.P., Development of Irrigation : Perspective Plan 2020 AD, Lucknow, 1985.

Note : Figures in parentheses show percentage to final anticipated potential.

Table VIII.7 : Balance Potential of Continuing Schemes of Surface Water in West U.P. (After VIth Plan)

Name of Scheme	Balance Potential ('000 ha.)
<u>Pre-VI Plan Schemes</u>	
1. Tehri Dam	243.30
2. Laknwar Vyasi	49.57
3. Kishau Dam	271.00
4. Jamrani Dam	41.57
5. Madhya Ganga Canal	172.00
6. Eastern Ganga Canal	105.00
7. Bewar Feeder	7.79
8. Madho Tanda	0.60
<u>Modernisation Schemes</u>	
1. Agra Canal	59.00
2. Upper Garda Canal	2.60
<u>Schemes For Conjunctive Use</u>	
1. Chambal Lift Scheme	55.40
2. Hindon Kishni	2.50
<u>New Schemes of VI Plan</u>	
1. Kotli Bhel Dam	310.90
<u>New Schemes of VII Plan</u>	
1. Eastern Ramganga	25.00
2. Chaugad Dam	71.00
3. Panchnad Dam	29.00
4. Madhya Ganga Canal	150.50
5. Jagner Dam	7.40
6. Teramoni Reservoir	10.60
7. Garra Barrage	33.00

Source : Irrigation Department U.P., Development of Irrigation, Perspective Plan 2020 AD, Lucknow, 1985

Note : For details of districtwise potential to be created see the cited reference.

VIII.4 Ground Water Potential and Exploitation

The Western Region of U.P. along with the other parts of the Gangetic Plains is endowed with abundant ground water, which is amenable to easy exploitation. The average depth of water table is below 5 mtrs. in 5 districts, between 5 and 7.5 mtrs. in 10 districts and between 7.5 and 15.0 mtrs. in the remaining 3 districts (Table VIII.6). Average water depth in general declines as one moves from western parts to eastern parts of the region (Map VIII.5). However, the rate of decline has not been very high or alarming. The extent of ground water utilization is not very high in most of the districts, being below 35 and 45 per cent in 11 districts and between 45 to 65 per cent in the remaining 5 districts (Table VIII.11 and Map VIII.6). In general the extent of ground water utilization is higher in the southern parts of the region as compared to the northern parts.

According to the studies of the Irrigation Department, U.P. Government, the irrigation potential from groundwater resources in West U.P. is 43.76 lakh hectares, which comes to 71.8 per cent of the net sown area in the region. Another 3.90 lakh ha. area can be irrigated through recharge after the completion of the ongoing surface scheme. Nearly 90 per cent of the ground water potential has been exploited. However an area of 4.95 lakh ha. can be irrigated by the balance of ground water resources and another 3.50 lakh ha. by conjunctive use with surface water. Table VIII.9 shows the districtwise potential and exploitation of groundwater resources in the region. Near

Table VIII.8 : Districtwise Underground Water Table in West U.P.
- 1985-87.

District	Average Depth Below Ground Level (Mtrs.)			Variation in Average Depth over 1979-87 (Mtrs)
	Maximum Depth	Minimum Depth	Average Depth	
Agra	14.4	14.3	14.4	+2.0
Aligarh	7.5	7.1	7.3	+1.3
Bareilly	4.1	2.8	3.5	+0.6
Bijnor	6.5	7.2	6.9	-1.1
Budaun	5.4	4.5	5.0	+0.6
Bulandshahr	9.3	8.7	9.0	+2.0
Etah	5.7	4.8	5.3	+0.5
Etawah	10.5	9.9	10.2	-0.7
Farrukhabad	8.8	8.1	8.5	-0.1
Ghaziabad	7.4	6.8	7.1	+1.1
Meerut	7.2	7.0	7.1	+1.1
Mainpuri	6.5	6.1	6.3	+0.3
Mathura	6.7	6.3	6.5	+1.6
Moradabad	6.2	5.7	5.9	+0.9
Muzaffarnagar	7.2	6.7	6.9	+1.3
Pilibhit	3.6	1.9	2.8	+0.3
Rampur	4.5	3.3	3.9	+0.5
Saharanpur	6.2	5.1	5.7	+1.3
Shahjahanpur	3.7	2.7	3.2	-0.5

Source : Calculated from the records of the State Groundwater Organisation, U.P.

saturation point has been reached in the districts of Meerut, Ghaziabad, Bulandshahr, Aligarh, Etah and Moradabad. However, in other districts there is still a good scope for expanding ground water irrigation facilities.

However, if one analyses the existing recharge and utilization of groundwater resources it would appear that there is a still greater possibility of expanding irrigation

Table VIII.9 : Existing and Potential Ground water Resources in West U.P.

('000 ha.)

District	Actual Irrigation 1981-82	Area which can be Irrigated by Balance Ground water	Total Irrigated Area By Ground Water	Percentage To Net Sown Area	Additional potential, of ground water through conjunctive use	Percentage of Net Sown Area
Agra	172	7	179	50.6	51	14.4
Aligarh	338	-	338	86.7	-	-
Bareilly	113	97	215	64.3	14	4.3
Bijnor	216	5	221	63.4	49	14.1
Budaun	213	1	214	53.1	27	6.8
Bulandshahr	361	-	361	106.7	-	-
Etah	191	-	191	62.1	14	4.6
Etawah	76	121	197	67.0	35	12.0
Farrukhabad	166	21	187	64.8	10	3.4
Ghaziabad	172	-	172	89.4	-	-
Meerut	296	-	296	94.3	-	-
Mainpuri	167	34	201	70.0	18	6.1
Mathura	131	18	149	49.3	43	14.3
Moradabad	375	-	375	79.4	-	-
Muzaffarnagar	223	25	248	74.3	37	11.1
Pilibhit	121	84	205	94.5	20	9.2
Rampur	105	28	133	71.5	10	5.2
Saharanpur	241	36	277	72.4	26	6.9
Shahjahanpur	198	18	216	62.4	36	10.4
West U.P.	3881	495	4376	71.8	290	6.4
U.P.	6940	4818	11758	67.3	1763	10.1

Sources: Irrigation Department, U.P., Development of Irrigation. Perspective Plan 2020 A.D., Lucknow 1965.

facilities in the region through ground water resources. Net recharge in the region has been estimated at 26.722 MCM and net

draft at 10.640 MCM leaving a balance of 16112 MCM. Assuming an annual draft of 0.022 MCM per tubewell and an irrigated area of 5 ha. per tubewell, additional number of feasible tubewells in the region comes at 7.32 lakhs with an irrigation potential of 36.63 lakh ha.

Table VIII.10 : Additional Potential of Irrigation Through Ground Water in West U.P., 1985.

1.	Net Recharge (MCM)	26722
2.	Net Draft (MCM)	10610
3.	Balance Unutilized (MCM)	16112
4.	Additional Nos. of Feasible Tubewells (lakhs)	7.32
5.	Additional Potential of Irrigation (Lakh ha.)	36.63
6.	Additional Potential As Per cent of Net Sown Area	60.4

Districtwise details of the groundwater recharge, utilization and water balance have been shown in Table VIII.11 together with the additional feasible tubewells and irrigation potential. Even if a part of this potential is exploited in the next ten years it will make a sizeable expansion of irrigation facilities in the region.

Table VIII.41 : Districtwise Ground Water Resources and Number of Feasible Ground Water Structures in West UP 1985

Districts	Annual Utilizable Recharge (MCM)	Net Annual Draft (MCM)	Ground Water Balance (MCM)	Stage of Ground Water Development (%)	Addit-ional Feasible Tube-Well No. of ('000)	Addit-ional Area Irrigated by Addit-ional Tube-Well ('000 ha)	Addit-ional Area Irrigated As % of Net Sown Area
Agra	1003.2	613.4	309.8	61.1	14.1	70.4	20.4
Aligarh	1451.5	841.9	609.6	58.8	28.7	139.5	35.5
Bareilly	1410.4	387.9	1022.5	27.5	46.5	232.4	57.8
Bijnor	1483.1	609.0	874.9	41.1	40.8	199.8	57.8
Budaun	1152.3	572.4	579.9	49.7	26.4	132.8	32.5
Bulandshahr	1655.2	593.2	1062.0	35.8	48.3	241.4	70.8
Etah	1186.3	471.4	714.9	39.7	32.5	162.5	55.0
Etawah	912.8	433.8	479.0	47.5	22.8	109.9	37.9
Farrukhabad	1203.7	577.4	626.4	48.0	28.5	142.4	51.0
Ghaziabad	1125.2	392.5	742.6	34.0	34.8	169.8	87.7
Meerut	1507.2	658.9	850.3	43.7	39.7	193.3	61.8
Mainpuri	1364.6	614.6	750.0	45.0	34.1	170.4	60.0
Mathura	1260.2	535.4	724.8	42.3	33.9	165.7	33.3
Moradabad	1678.8	721.6	1156.4	38.4	58.6	263.8	54.3
Muzaffarnagar	1836.1	668.8	1167.3	36.4	53.1	265.3	75.2
Pilibhit	1735.7	265.5	1450.2	16.5	66.9	330.6	149.3
Rampur	730.6	307.0	434.6	41.5	20.6	98.9	51.8
Saharanpur	2187.0	768.8	1410.2	35.2	64.1	321.5	84.2
Shahjahanpur	1636.2	566.7	1069.4	34.5	49.6	243.0	70.0

VIII.5 Conclusion

Western Region of U.P. is well endowed with ground and surface water resources. The region has a long tradition of irrigated agriculture and has a well developed irrigation network of canals and tubewells. Already about 77 per cent area

has been brought under irrigation, out of which nearly two-third is irrigated by tubewells and about one-fourth by canals. There is still a large unexploited potential of both surface and ground water resources in the region. The region can attain an irrigation potential of 101 per cent of its net sown area - 71 per cent by surface water and 30 per cent by ground water.

The strategy of water resource development for the region should aim at a more intensive use of water resources and its scientific management so as to increase the productivity of crops and raise intensity of cropping. The region presents suitable conditions for growing water intensive crops like wheat, sugarcane and paddy. Development of quick maturing and water responsive varieties of pulses, oilseeds, sugarcane, coarse cereals and fodder crops would help in raising cropping intensity and agricultural incomes.

At the same time attention should be given to the expansion of irrigation facilities in the lagging districts particularly Agra, Bareilly, Bijnor, Budaun, Etawah, Farrukhabad, and Shahjahanpur. All these districts are likely to benefit from the ongoing schemes of surface water, while Bareilly and Etawah have good hope for developing ground water resources.

As a result of the rapid expansion of tubewells in the region, near saturation point has come in the field of ground water exploitation in some districts notably Meerut, Gaziabad, Bulandshahr, Aligarh, Etah and Moradabad. However, it is felt

that there is a still good scope for the exploitation of ground water in several districts of the region with continuous monitoring of the water table.

The region presents suitable conditions for the conjunctive use of ground and surface water over most parts. Hence simultaneous emphasis should be put on the expansion and utilization of surface and ground water resources. This will help in controlling the problem of waterlogging and salinity along canal banks, while increasing water recharge for groundwells.

Finally, development of water resources has to be linked up with the programmes of wasteland development and afforestation in the region.

CHAPTER IX

FOREST RESOURCES

IX.1 Introduction

The major environmental concern in West U.P. is the extremely low forest coverage, much below the recommended norm of 20 per cent for the plains. Moreover, the forest area as reported in revenue statistics fails to give a correct idea about the effective tree coverage. Fortunately, we now have land sat imagery data about the area under forests at the district level. However, the remote sensing data shows a much smaller area under forests as compared to revenue data. This has led to a futile controversy about the extent of forest cover. In our opinion, the estimate based on land sat imagery should be taken as a truer indicator of actual forest cover which is more relevant from the ecological point of view. The official forest statistics indicate the area which has been declared as forest area but which may or may not be covered by green canopy. The gap between the two provides an idea of the potential area which can be brought under given green cover without diverting area from other land uses.

IX.2 Forest Cover

We have already discussed the extent of and trends in forest cover in the region as revealed by revenue statistics in chapter

VI. Here our main focus would be on remote sensing data on forest cover. We have calculated manually districtwise data on forests from NRSA maps for 1972-75 and 1980-82. Total forest area of U.P. as calculated by us is very close to NRSA estimates. For 1991 Forest Survey of India has released districtwise data under forests, which may be regarded as the first authentic district level estimate of effective forest cover. The relevant data is reproduced in Table IX.1.

The total forest area in West U.P. as estimated by the Forest Survey of India is only 2508 Sq. Km. which is only 3.05 per cent of the geographical area of the region. Hardly 45 per cent of this is dense forest cover. Only 3 districts, namely, Pilibhit, Saharanpur and Signor have sizeable forest area - over 10 per cent of the total geographical area. Three more districts - Agra, Etawah and Shahjahanpur have forest stretches exceeding 100 Sq. Km. The remaining 13 districts of the region are practically devoid of any forest cover, reflecting an extreme ecological imbalance.

According to the official statistics 4.60 per cent of the area in the region is under forest, which is much higher than the forest cover of 3.05 per cent as reported by Forest Survey of India. Thus it would appear that hardly 30 per cent of the official forest area, meagre as it is, is having a dense green canopy.

The latest remote sensing data indicate that forest cover in the western as well as in the state as a whole has increased during the eighties whereas in the seventies the trend was

Table IX.1 : Districtwise Forest Cover in West U.P. According to Land Sat Imagery, 1991.

(Sq. Km.)

District	Dense Forests	Open forests	Total forests	Forests as per cent of Geographical area	Forest area according to official statistics	
					Area	Per cent Area
Agra	25	105	130	2.71	396	8.30
Aligarh	-	-	-	-	10	0.19
Bareilly	-	-	-	-	3	0.07
Bijnor	275	282	557	11.49	687	14.06
Budaun	-	6	6	0.12	67	1.34
Bulandshahr	-	6	6	0.14	62	1.23
Etah	-	-	-	-	2	0.03
Etawah	1	135	136	3.14	404	9.25
Farrukhabad	-	3	3	0.07	53	1.35
Ghaziabad	-	-	-	-	26	0.99
Meerut	-	21	21	0.54	80	2.04
Mainpuri	-	7	7	0.16	58	1.24
Mathura	-	13	13	0.34	16	0.46
Moradabad	-	9	9	0.13	119	2.01
Muzaffarnagar	-	26	26	0.62	130	4.31
Philibhit	478	270	748	21.38	782	22.37
Rampur	-	39	39	1.65	66	2.60
Saharanpur	255	452	707	12.64	796	14.42
Shahjahanpur	92	6	100	2.19	112	2.45
West U.P.	1126	1382	2508	3.05	3948	8.50

Source : For landsat imagery data State of Forest Report, 1991, Forest Survey of India, Dehra Dun; For official statistics Agricultural Statistics of U.P., 1987-88.

negative (Table IX.2). The improvement was, however, mainly in the open forest category. The official statistics also show that the declining trend in forest area has been arrested after 1976.

Table IX.2 : Trends In Forest Cover According To Land Sat Imagery In West U.P. and Uttar Pradesh

(Per cent)

Item	West U.P.	Uttar Pradesh
<u>1. Closed Forest Area</u>		
1972-75	4.79	8.22
1980-82	4.59	8.17
1989-91	4.37	7.70
<u>2. Open Forest Area</u>		
1972-75	0.06	0.57
1980-82	0.04	0.97
1989-91	1.68	3.72
<u>3. Total Forest Area</u>		
1972-75	4.85	8.79
1980-82	4.63	7.14
1989-91	3.05	11.42

Source: Figures for 1972-75 and 1980-82 are based on our calculations from NRSA maps. Figures for 1989-91 have been taken from The State of Forest Report, 1991 Forest Survey of India, Dehra Dun, 1992.

IX.3 Forest Types

Entire forest area in the region is under the control of the Forest Department. Except for about 10 per cent of the unclassified forests the forests in the region fall under the category of reserved forests.

The main forest types found in the region are the tropical moist and dry forests. Tropical moist deciduous forests are found in the northern terai with sal as the major specie. In other parts of the region sub-tropical dry deciduous forests occur. Shisham, babul, khair and sawal are the main species found in these parts.

IX.4 Forest Status

As we have already said less than half of the forest area in the region is covered by dense green canopy. Thus bulk of the forest area is in the category of open forests with limited coverage. The onslaught of ever increasing human and livestock population with the associated evils of theft, illegal felling, firewood collection and over grazing has resulted in severe degradation of forests. The process of degradation has reached such an alarming stage that the process of natural regeneration has been seriously affected. According to a study of Saharanpur district, which accounts for about 30 per cent of the forest area of the region, the regeneration status was adequate only on 1.5 per cent of the forest area, inadequate on 9.4 per cent area and absent on 89.1 per cent area (The State of Forest Report, 1987, p.43).

IX.5 Forest Produce

Total timber production in West U.P. according to Forest Department Statistics was 1.12 lakh Cu.M. in 1981-82, while the production of fuelwood is estimated at 1.15 lakh Cu.M. The

region's share in timber and fuelwood output in U.P. comes to only 17.2 per cent and 6.6 per cent respectively. In per capita terms the output of timber and fuelwood comes to only 0.0028 Cu.M. A few districts like Bijnor, Moradabad, Pilibhit and Saharanpur contribute an overwhelming part of total forest produce in the region (Table IX.3).

Per capita net income from forestry and logging has been estimated at only Rs.6.6 for West U.P. The figure is nominal in most of the districts of the region except Bijnor and Pilibhit (Table IX.3).

Per hectare productivity in the region comes to only 0.285 Cu.M. of timber and 0.291 Cu.M. of firewood. If an adjustment is made for unrecorded produce and theft, which is put at 10 per cent in case of timber and 1000 per cent in case of firewood, productivity per hectare rises to 0.314 Cu.M. of timber and 3.201 Cu.M. of firewood. This compares with the estimate of 0.06 Cu.M. for Gangetic Plain in the forest reasonably protected from biotic injuries (The State of Forest Report 1967, p.31). Clearly the off take of wood from forests in the region is much above the silviculturally permissible limits.

A rough estimate of the demand and supply gap for forest produce has been attempted by us. Per capita consumption of timber has been taken at 0.0351 Cu.M. on the basis of the national requirement of 275.8 lakh Cu.M. estimated by the Forest Survey of India, while per capita requirement of fuelwood has been estimated

Table IX.3 : Districtwise Production of Timber and Fuelwood in West U.P., 1981-82.

District	Timber (Cu.M.)	Fuelwood (Cu.M.)	Per Capita Net output from Forestry and logging 1983- 84 (Rs.)
Agra	-	2690	5.0
Aligarh	4	-	-
Bareilly	83	1264	-
Bijnor	33017	36829	55.8
Budaun	-	-	1.1
Bulandshahr	282	-	4.1
Etah	5	251	-
Etawah	146	-	1.0
Farrukhabad	12	-	-
Ghaziabad	59	1172	-
Meerut	184	3692	1.6
Mainpuri	11	772	4.1
Mathura	-	523	1.9
Moradabad	37749	23231	2.2
Muzaffarnagar	494	900	-
Philibhit	33591	10390	19.0
Rampur	2531	9599	15.0
Saharanpur	253	21954	11.2
Shahjahanpur	2911	1772	2.0
West U.P.	112432	115042	6.6

Source : Forest Statistics Uttar Pradesh, 1983.
Statistical Abstract, Uttar Pradesh, 1988.

at 0.1637 Cu.M. on the basis of U.P.'s consumption at 171.8 lakh Cu.M. as revealed by NSS 28th Round. On this basis total requirement of fuelwood in the Western Region in 1981 for timber can be put at 13.81 lakh Cu.M. as compared to the reported production of 1.15 lakh Cu.M. and 1.12 lakh Cu.M. respectively. Thus there is a staggering shortage of timber and fuelwood in the region (Table IX.4).

Table IX.4 : Consumption and Production of Timber and Firewood in West U.P., 1981-82.

Item	Timber	Firewood
Total Consumption (Lakh Cu.M.)	13.81	64.42
Total Production (Lakh Cu.M.)	1.12	1.15
Per Capita (Cu.M.)	0.0351	0.1637
Per Capita Production (Cu.M.)	0.0028	0.0029
Production As Per cent of Consumption	8.1	1.8

IX.6 Forest Development and Conservation

Limited forest cover is the major environmental problem for the Western Region of U.P. Against the recommended norm of 20 per cent of forest cover in the plains forest area in the region according to forest statistics is only 4.6 per cent, while effective forest cover according to remote sensing data is only 3.1 per cent, out of which less than half is under close cover. Thus the situation is quite alarming and poses a serious threat to the sustainable development of the region. Thus the highest

priority in land use planning is the region has to be given to extending forest cover in the region to the extent possible.

It would be a Utopian proposal to bring 20 per cent of land area under forest cover in the region. Hence, it is recommended that in the next ten years atleast 10 per cent of area in the region should be brought under green cover. The first priority should be to rejuvenate the open forest area which is estimated at 2.62 lakh ha.

In order to bring the forest cover to the recommended 10 per cent an additional area of 5.14 lakh ha. has to be brought under afforestation by diverting area under the categories like culturable wasteland, pastures and grazing land, current and old fallows. Nearly 3 lakh ha. area under these categories is available in the region.

We have shown in Table IX.5 districtwise area to be rejuvenated and additional area to be brought under afforestation along with the area available under the above categories. In most of the districts adequate area is available under these categories to be brought under forestry. In the districts of Aligarh, Bareilly, Bulandshahr, Meerut, Moradabad, Muzaffarnagar and Rampur, where adequate area is not available efforts have to be made to promote agro-forestry by diverting lands with low productivity to agro-forestry.

Since bulk of area under wastelands, pastures and fallows is likely to be under private ownership well planned schemes should

Table IX.5 : Districtwise Existing and Required Forest Cover in West U.P.

(100 ha.)

District	Required Forest Area	Official Forest Area	Classed forest Area	Open forest to be rejuvanted	Additional area to be forested	Available Area under waste-land fallow etc.	Area To be brought under Agro-forestry
Agra	480	376	25	371	84	393	-
Aligarh	500	10	-	-	490	374	126
Bareilly	410	3	-	-	407	241	166
Bijnor	490	687	273	412	-	777	-
Budaun	320	69	-	69	451	567	-
Bulandshahr	440	82	-	82	358	331	27
Etah	440	2	-	2	438	892	-
Etawan	440	404	1	403	56	12	-
Farrukhabad	420	58	-	58	362	716	-
Ghaziabad	260	80	-	80	180	253	-
Kaerut	390	26	-	26	364	200	184
Mainpuri	430	58	-	58	372	760	-
Mathura	380	18	-	18	362	360	2
Moradabad	590	119	-	119	471	289	102
Muzaffarnagar	420	180	-	180	240	123	113
Philibhit	350	782	472	304	-	197	-
Rampur	240	66	-	66	174	66	106
Saharanpur	550	796	253	541	-	196	-
Shanlshanpur	460	112	92	20	348	111	-
West U.P.	8210	3943	1126	2822	5187	7769	650

be launched to persuade farmers to take up tree plantation and agro-forestry. Plantation of trees along canals, roads, railways and other public lands under social forestry schemes needs to be taken up on a large scale to restore the ecological balance in the region. These efforts would also help in easing the problem of fuelwood shortage and biotic pressure on existing forests.

Simultaneous efforts are needed for promoting cultivation of fodder crops and grasses to meet the fodder requirements of livestock and prevent destruction of forests through overgrazing. Finally, the development and conservation of forest resources requires the education and mobilization of the people on a mass scale.

CHAPTER X

WASTELAND DEVELOPMENT

X.1 Introduction

A major problem of land use is the reclamation of wastelands and putting them to environmentally sound productive use. Wastelands are caused both by natural causes as well as unthoughtful human intervention. Although wastelands are variously defined, in the context of land use planning we should take a broader view and include among wastelands not only barren and degraded lands but also land under low productive use such as pastures and grazing land, marginal lands under cultivation as well as fallow lands and open forest lands.

X.2 Estimates of Wastelands

An assessment of the magnitude of the area under wasteland is beset with the problem of definition and availability of data. The revenue statistics of the state customarily give data on two categories of wastelands, namely (a) barren and unculturable land and (b) culturable wasteland. More recently National Remote Sensing Agency has also made available data based on landsat imagery on

wastelands at the state level and for selected districts as well. The two sets of data are vastly different and apparently irreconcilable. Thus total wastelands in U.P. as per revenue statistics cover 22.38 lakh ha. against the NRGA estimate of 43.16 lakh ha. According to the calculations of the Remote Sensing Application Centre, U.P. total wastelands in 20 selected districts of U.P. for which the studies were carried out is 9.97 lakh ha. while according to revenue statistics total wasteland in these districts is 8.66 lakh ha.

Table X.1 gives detailed data on wastelands by categories in four western districts for which data have been released by the Remote Application Centre, U.P. Wasteland as per cent of geographical area is reported as 7.6 in Farrukhabad, 5.6 in Agra, 11.8 in Etawah and 12.6 in Mainpuri. However, according to our calculations from NRGA Wasteland Maps for U.P. the proportion of wasteland to total area in these four districts was much higher 9.8 per cent in Farrukhabad, 21.9 per cent in Agra, 29.4 per cent in Etawah and 21.5 per cent in Mainpuri. On the other hand wastelands area according to revenue statistics is on the lower side - 10 per cent, 4.27 per cent, 8.47 and 12.4 per cent respectively in the four districts. There is thus need for a more systematic identification of area classified as wastelands.

Table X.1 : Wasteland Area In Selected Districts of U.P. As Per Land Sat Imagery, 1986.

(Sq. Km.)

Type of Wasteland	Agra	Etawah	Farrukha- bad	Mainpuri
1. Gullied & Ravinous Land	263.4	268.6	37.2	38.6
2. Uplands with or without shrubs	67.9	2.3	0.4	-
3. Saline & Alkaline Land	22.2	205.2	188.0	487.4
4. Barren Rocky/ Stoney Land	42.6	-	-	-
5. Degraded Forest Land	10.2	8.5	-	4.3
6. Sandy Lands	4.3	-	1.4	6.0
7. Water Logged & Marshy Lands	2.9	24.1	76.0	15.9
Total Area of Wasteland	413.5	509.3	323.0	547.2
Wastelands As Per cent of Total Area	8.6	11.8	7.6	12.6

Source: Remote Sensing Application Centre, Lucknow.

We have already analysed area under wasteland according to revenue statistics in Chapter VI. To recapitulate, an area of 2.80 lakh ha. is classified as barren and uncultivable land and 1.80 lakh ha. as culturable wasteland, which comes to 3.41 per cent and 2.19 per cent of

geographical area of the region. Area under these two categories has undergone substantial reduction over the years. At the district level area under barren and uncultivable land varies from 1.1 per cent to 8.9 per cent of total area, while area under culturable wasteland varies from 0.46 per cent to 8.68 per cent of total area (Table VI.4). The problem of wasteland is relatively more serious in the districts of Aligarh, Etah, Etawah, Farrukhabad and Mainpuri.

In Table X.2 we show districtwise area under different types of wastelands calculated by us from NRSA Wasteland Map for U.P. for 1980-82. Total wasteland area is estimated at 7762 sq. km. or 9.3 per cent of geographical area of the region. In 3 districts less than 5 per cent of area is under wastelands, in 2 districts 5 to 10 per cent area is under wasteland, in 6 districts 10 to 20 per cent area is under wasteland, while in 3 districts 20 to 30 per cent area comes under this category. The problem of wastelands is relatively more severe in the following ten districts : Agra, Aligarh, Budaun, Bulandshahr, Etah, Etawah, Farrukhabad, Mainpuri, Mathura and Moradabad. In the remaining nine districts area under wastelands is relatively low.

Table X.2 : Districtwise Wastelands In West U.P. As Per Landsat Imagery 1980-82

(Area in Sq. Km.)

Districts	Salt Affected Land	Gullied or Ravines Land	Water logging	Undulating Upland	Jhum or Forest Blank	Sandy Area	Total Culturable waste-land	Total Non-Culturable Waste-land	Total Waste-land	% of Waste-land to Total Area
Agra	57.5	997.0	-	-	-	-	1054.5	-	1054.5	21.7
Aligarh	497.0	-	20.5	-	-	-	517.5	-	517.5	10.3
Bareilly	130.5	-	-	-	-	-	130.5	-	130.5	3.2
Bijnor	22.0	-	-	-	-	88.0	110.0	-	110.0	2.3
Budaun	101.5	-	-	-	-	563.5	665.0	-	665.0	12.8
Bulandshahr	489.0	-	-	-	-	-	489.0	-	489.0	11.2
Etah	494.5	-	20.5	-	-	-	515.0	-	515.0	11.6
Etawah	386.0	880.0	8.0	-	-	-	1274.0	-	1274.0	29.4
Farrukhabad	420.0	-	-	-	-	-	420.0	-	420.0	9.8
Ghaziabad	145.0	-	-	-	-	-	145.0	-	145.0	3.6
Meerut	61.5	-	-	-	-	-	61.5	-	61.5	1.6
Mainpuri	746.0	188.0	-	-	-	-	934.0	-	934.0	21.3
Mathura	103.0	397.0	-	-	-	-	500.0	-	500.0	13.1
Moradabad	146.5	-	-	-	-	485.5	632.0	-	632.0	10.6
Muzaffarnagar	76.0	-	-	-	-	-	76.0	-	76.0	1.8
Pilibhit	-	-	11.5	-	38.5	18.5	68.5	-	68.5	1.9
Rampur	18.0	-	-	-	-	-	18.0	-	18.0	0.7
Saharanpur	29.5	-	40.0	-	-	-	69.5	-	69.5	1.2
Shahjahanpur	50.5	-	51.0	-	-	-	101.5	-	101.5	2.2
West U.P.	3974.0	2459.0	151.5	-	38.5	1155.5	7781.5	-	7781.5	9.5

Source: Calculated from NRSA Wasteland Map For U.P., 1980-82.

X.3 Types of Wastelands

Non-culturable wastelands like rocky, steep sloping area or snow covered area are not found in the region. However, according to revenue statistics about 2.8 lakh ha. of barren and uncultivable land exist in the region constituting 3.4 per cent of the geographical area. Continuous decline in the area in this category would suggest that these lands can be and are being reclaimed.

The major type of wastelands found in Western U.P. consists of the salt affected area which cover nearly 2974 sq. km. area or 51 per cent of total wastelands. The problem of ravinous land have affected 2459 sq. km. area or 31.6 per cent of wasteland area. Other types of wastelands found in the region include 1455.5 sq. km. of sandy area, 151.5 sq. km. of waterlogged area and 38.5 sq. km. of forest blanks (Table X.2). The salt affected areas are found in all districts of the region except Pilibhit. The most seriously affected districts are Mainpuri, Aligarh, Etah, Bulandshahr, Farrukhabad and Etawah (Table X.2). The problem of gullied and ravinous land is confined to the districts of Agra, Etawah, Mainpuri and Mathura and mainly occur on the sides of river Yamuna and Chambal. Sandy areas are mainly found in the districts of Budaun, Moradabad, Sitapur and Pilibhit. Tracts of waterlogged areas are come across in the districts of Aligarh, Etah, Etawah and Pilibhit while forest blanks are confined to Pilibhit district alone.

X.4 Wasteland Reclamation

The methods of wasteland reclamation and their economic benefits would vary according to the nature of the wastelands. As mentioned above the two main types of wastelands found in Western region of U.P. are the salt affected and ravinous lands. The problem of soil alkalinity emerged on a large scale in U.P. with the spread of the canal network and the Reh Commission was set up as early as 1876. About half a century later the User Land Reclamation Committee was appointed by the state government in 1938-39. Efforts for the reclamation of the salt affected lands have continued under the various Five Year Plans though the progress has been far from satisfactory.

Most of the salt affected land in U.P. belongs to the category of alkali soils which have preponderance of carbonate and bicarbonate. The package of reclamation technology for alkali soils consists of proper levelling and drainage, soil amendment through application of gypsum or pyrites, lowering of water table and proper agronomy practices. The major obstacles in the adoption of wasteland reclamation technology is the high cost involved which is in the range of Rs.20,000 per ha., well beyond the capacity of the small and marginal farmers. A suitable policy package has to be developed for large scale adoption of the reclamation technology. It is expected that the recently

launched U.P. Usar Reclamation Project with World Bank assistance will help in reclamation of large area under alkali lands.

Ravines pose an even more intractable problem. Ravines are extensive systems of gullies of varying depth along the banks of the rivers Yamuna and Chambal and their tributaries. Though the ravines are a natural phenomenon, they have been aggravated by uncaring human intervention through deforestation, overgrazing and unscientific cultivation.

The cost of reclamation of medium and deep ravines would be prohibitive, but shallow ravines are suitable for reclamation for agricultural purposes. The problem of ravine reclamation has received the attention of the authorities for long. Work on afforestation of ravines was taken up in Etawah district in the latter part of the last century. After Independence pilot projects on survey and reclamation of ravines have been taken up both on the initiative of the state and the central governments. A regional soil conservation research centre has been established by the central government at Agra.

A comprehensive perspective plan for ravine reclamation covering the period 1972-73 to 1998-99 has been prepared by a Working Group On Ravine Reclamation set up by the Ministry of Home Affairs, Government of India. Under the plan an expenditure of Rs.608 crores was envisaged for ravine control

measures over 7 lakh ha. area in U.P. More recently a Central Sector Scheme was launched in 1987 for special area plan for erosion prone districts which have large ravine lands.

The Working Group of the Planning Commission has rightly recommended that the first priority should be given to protect the table lands from encroachment of ravines through construction of peripheral lands, masonry outlets and check dams, land levelling and vegetative cover for safe disposal of surplus run off water. The second priority is to be given to afforestation of medium and deep ravines. Reclamation of shallow ravines may be taken up after that within available resources. The strategy recommended by the Working Group should be vigorously pursued and adequate funds should be provided for the programme.

For the development of waterlogged and sandy areas proper irrigation, drainage and water management techniques with suitable tree plantation work have to be undertaken.

X.5 Approach To Wasteland Development

The existence of wastelands constitutes a wasted economic potential of enormous significance. It is estimated that with application of proper reclamation technology each hectare of wasteland can yield 3 to 5 tonnes of foodgrains or 50 to 100 tonnes of fuelwood per year. Development of wastelands would also help augment the supply of animal feed

and fodder. Wasteland development would contribute to the restoration of ecological balance and prevention of soil erosion. Besides these social benefits development of wastelands would contribute substantially in improving the economic conditions of the marginal farmers and landless labourers. In view of these considerations reclamation of wastelands should be given a very high priority in our Five Year Plans.

In the following paragraphs we have made a few suggestions regarding the approach to wasteland development. The first requirement is the correct identification of the magnitude and location of various types of wastelands by using both remote sensing and field level data.

The primary consideration in wasteland development has to be the restoration of environmental balance rather than foodgrain production. Priority should, therefore, be given for reclamation of wasteland for social forestry to meet the fuelwood and fodder requirement of the local poor. Landless labourers should be encouraged to take up tree plantation rather than cultivation on the allotted lands.

For drawing up programmes of wasteland development the ownership pattern of the wastelands has to be kept in mind. Though precise information on this aspect is not available, it would be reasonable to believe that the bulk of wastelands are privately owned. The government has to provide adequate

subsidies and arrange for credit and other inputs and technical know-how to the farmers to undertake development of the privately owned wastelands.

Wasteland development programmes have to be closely integrated with the programmes related to irrigation, soil conservation and afforestation. For this proper coordination between the concerned departments has to be ensured at different levels.

Finally, the enormous task of wasteland development cannot be accomplished without the active participation of the voluntary organizations and the village committees. This is possible only when the local people perceive a close link between their efforts and the fulfilment of their urgent needs of fuelwood, fodder, etc.

CHAPTER XI

SUMMARY AND SUGGESTIONS

I. Introduction

Land is the most precious resource which is vital for the well being and sustenance of the people. The relentlessly increasing pressure of human and livestock population and the demands of urbanization and infrastructure have put a severe strain on our limited land resources. The sad neglect and unthinking over exploitation of the land resources has caused a serious deterioration of the quality of the land resources and threatened the ecological balance.

Clearly this state of affairs cannot be allowed to continue unchecked any longer. We have to adopt an integrated approach to the scientific management, conservation and development of our land resources. Perspective land use plans for different regions and sub-regions of the country have to be prepared to ensure an optimum land use keeping in view the objectives of the maximization of output per unit of land as well as environmental balance and sustainable development. Such land use plans have to be based on a detailed study of the competing demands for various land uses on the one hand and the suitability and capability of land on the other hand.

In the following paragraphs we have summarized the findings of our study and suggested a perspective land use plan for the Western Region of Uttar Pradesh and suggested an institutional mechanism for operationalising the plan.

II. The Physical Setting

The Western Region of U.P. comprises 21 districts spread over 82,189 Sq. Km. With an average relief between 80 M. and 250 M. the region presents a featureless topography, with the exception of the sub-mountain tarai-bhabar and the ravinous landscape along the Yamuna and Chambal on its western boundary.

Western U.P. is endowed with agro-climatic conditions highly favourable for agricultural development. The Region forms part of the well integrated drainage system of the Ganga and has rich surface and ground water resources, which are easily exploitable. The region has a sub-humid climate with plenty of sunshine. It receives an average annual rainfall of 96 cm. The south-western part is the driest zone of the region. Rainfall is, however, subject to a high degree of variability often creating drought conditions. The region is blessed with very fertile alluvial soil. Large patches of saline soils are also found in a number of districts.

Though the entire West U.P. falls in the upper Gangetic plains, for the purposes of land use planning the region needs to be classified into two distinct agro-climatic zones:

- (a) North West U.P. comprising the districts of Bareilly, Bijnor, Bulandshahr, Ghaziabad, Hardwar, Meerut, Moradabad, Muzaffarnagar, Rampur, Saharanpur and Shahjahanpur; and,
- (b) South West U.P. comprising the districts of Agra, Aligarh, Budaun, Etah, Etawah, Farrukhabad, Firozabad, Mainpuri and Mathura.

III. Population

The heavy and rising biotic pressure in the region puts severe limitations on land use planning. According to the census of 1991 total population of West U.P. was 494 lakhs giving a population density of 601 persons per sq. km. Nearly 75 per cent of the population is living in the rural areas and net sown area per capita has shrunk to 0.20 ha. During the last two decades population growth has remained steady at 2.27 per cent per annum.

The region is in a stage of demographic explosion. We have assumed that population growth rate would be 2.23 per cent in 2000 and 2.12 per cent in 2010. On this basis population of the region would be 601.9 lakhs in 2001 and 746.5 lakhs in 2011. The medium projection gives the figures of 587.9 lakhs and 681.9 lakhs respectively for the two

years. Thus an increase of 40 to 50 per cent can be expected in the population of the region between 1991 and 2011. The proportion of rural population is likely to go down from 76.6 per cent to 61.1 per cent over the period.

IV. Demand Projections

Demand for major agricultural commodities for the year 2001 and 2011 has been projected by first projecting per capita demand for different commodities on the basis of the computed income elasticities from NSS consumption data and assuming an increase in per capita consumption at 2 per cent per annum for rural areas and 3 per cent for urban areas. Total demand has then been derived by multiplying projected per capita demand by medium population projections and adding 20 per cent on account of feed, seed, wastage and industrial demand.

Demand for foodgrains is expected to increase at a rate of 4 per cent per annum between 1991 and 2011. Even sharper increases in demand are expected to take place in the case of non-foodgrain items like milk, sugar, vegetables, etc. These may be termed as high projections.

Two alternative projections have also been worked out by using the base year consumption levels and recommended nutritional norms. These may be termed as corresponding to the medium and low projections. The three sets of demand

Table X.1 : Alternative Demand Projections For West U.P.

(Lakh tonnes)

Commodity	1970-71			2000-2001			2010-2011		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
1. Cereals	172.8	116.5	94.0	255.2	138.6	113.0	367.0	158.4	141.6
2. Pulses	16.8	11.0	10.1	25.2	13.5	12.4	37.1	15.8	15.4
3. Foodgrains	198.2	127.5	104.1	301.1	152.2	127.4	442.7	174.2	157.0
4. Milk	42.6	21.8	47.4	72.1	26.5	58.0	117.2	31.0	71.9
5. Fats & Oils	4.2	2.6	7.3	6.7	2.9	9.0	10.3	3.4	11.2
6. Sugar & Khandsari	5.2	3.1	7.3	8.6	4.0	9.0	13.9	4.9	11.2
7. Vegetables	50.3	31.4	24.4	80.3	39.2	29.9	124.0	46.9	37.0

The required rate of growth in foodgrains output between 1986 and 2011 comes to 31.7 per cent, 46.1 per cent and 271.3 per cent according to our low, medium and high projections. Considering the favourable agricultural situation in the region the target should be at least doubling of the output in the next two decades, i.e., an annual growth rate of about 3.5 per cent.

V. Supply Trends and Possibilities

The agricultural economy of Western Region has performed better than the state as a whole. In the post green revolution the region has recorded an annual growth rate of

4.55 per cent in case of cereals, 3.80 per cent in case of foodgrains as well as oilseeds and 3.38 per cent in case of sugarcane. The performance of coarse cereals has, however, been unsatisfactory and that of pulses negative. At the district level growth of foodgrains output has varied between 2.0 and 7.0 per cent with districts in the south west registering relatively lower growth rates.

The analysis of demand and supply balances shows that the growth of agricultural output is slightly lagging behind the increase in demand. Over the next twenty years the region is expected to remain a surplus region in case of rice, wheat, and sugarcane, but there will be large deficits as far as coarse cereals, pulses and oilseeds are concerned.

The momentum of agricultural growth has to be maintained in future. Though West U.P. is agriculturally the most developed region of the state the absolute level of yields of most of the crops is still low and there is a large unexploited technological lag yet to be exploited through intensification of the new technology. The intra-regional variations in productivity and growth rates also need attention of the planners.

Cropping Pattern

The cropping pattern in the region is well developed with about 20 per cent area under commercial crops. The major specialisation of the region is in wheat, sugarcane,

rice, coarse cereals and oilseeds. Following four cropping zones have been identified reflecting the variations in agro-climatic conditions:

- (i) Wheat, Rice and Sugarcane Zone covering the districts of Bareilly, Bijnor, Moradabad, Muzaffarnagar, Pilibhit, Rampur, Saharanpur and Shahjahanpur;
- (ii) Wheat, Coarse Cereals and Oilseeds Zones covering the districts of Agra, Aligarh and Mathura;
- (iii) Wheat, Maize and Sugarcane Zone covering the districts of Bulandshahr, Ghaziabad and Meerut; and,
- (iv) Wheat, Coarse Cereals and Rice Zone covering the districts of Budaun, Etah, Etawah, Farrukhabad and Mainpuri.

In the wake of the green revolution major shifts have taken place in the cropping pattern in favour of wheat, rice, sugarcane and rapeseed and mustard at the cost of coarse cereals and pulses. The region has a comparative advantage in the cultivation of irrigation and fertiliser responsive crops. However, further expansion of area under wheat and rice, which account for 34 and 12 per cent of gross cropped area respectively, would not be desirable for maintaining diversity and balance in the cropping pattern. Cultivation of high value commercial crops like sugarcane, rapeseed and mustard, vegetables, etc. needs to be encouraged. Emphasis is also required on expansion of area under horticulture and

agro forestry to expand tree coverage and check wind erosion. Cultivation of fodder crops like maize, bajra, legumes and barseen should be promoted to reduce the shortage of green fodder.

It should be possible to bring more area under these crops without a decline in area under cereals through promoting multiple cropping. Cropping intensity can be raised to 200 from the present level of 154. This would require expansion of irrigation facilities on the one hand and development of high yielding and quick maturing varieties of crops like sugarcane, oilseeds and pulses. Agricultural research and extension systems have to be geared to achieve these objectives.

VII. Livestock Resources

Animal husbandry is an important component of the rural economy of Western U.P. There were 173.3 lakh livestock in the region in 1982, of which 48.5 per cent were buffaloes and 33.3 per cent cattle. The number of livestock has increased at a rate of 1.34 per cent per annum over the period 1966-82. West U.P. is a major milk producing region of the state. Milk output in recent years has been increasing at a rate of around 4 per cent per year.

average. Average daily milk yield in the region has been estimated at 2.82 Kg. per cow and 3.74 per buffalo.

The livestock density comes to 1.9 per hectare of net sown area, 16 per hectare of fodder crop area and as much as 468 per hectare of pastures and grazing land. Thus the livestock population is well above the carrying capacity of the land. The requirement of dry fodder has been estimated at 164.2 lakh tonnes against the availability of 105.3 lakh tonnes. The deficiency of concentrates is even more acute with an availability of only 7.1 lakh tonnes against the requirement of 26.3 lakh tonnes. The availability of green fodder is, however, adequate - 287.5 lakh tonnes against a requirement of 238.8 lakh tonnes.

The region offers great potential for the development of animal husbandry. The strategy should aim at the reduction in the number and improvement in the quality of the livestock. The infrastructure of veterinary services has to be expanded and streamlined. Arrangements have to be made for augmenting the feed and fodder supply. Cultivation of fodder crops on commercial lines should be encouraged.

VIII. Water Resources

West U.P. is well endowed with ground and surface water resources. About 77 per cent of cultivated area receives irrigation. The region can attain an irrigation potential of 150 per cent of its net sown area. The strategy of water

resource development for the region should aim at a more intensive use of water resources and its scientific management to increase crop productivity and cropping intensity.

There are significant intra-regional disparities in irrigation facilities. Attention should be given to the expansion of irrigation facilities in the lagging districts particularly Agra, Bareilly, Bijnor, Budaut, Etawah, Farrukhabad and Shahjahanpur. Emphasis should be put on early completion of on-going surface water schemes in these districts.

The region presents suitable conditions for water. This will help in controlling the problem of waterlogging and salinity along canal banks, while increasing water recharge for groundwells. There is still a good scope for the exploitation of ground water in the region, except a few districts where near saturation point has been reached. Through the decline in the water table has not been alarming, there is a need of continuous monitoring of the water table.

IX. Forest Resources

Limited forest cover is the major environmental problem of the Western Region of U.P. Forest area in the region according to revenue statistics is only 4.8 per cent of geographical area. However, effective forest cover according to remote sensing data is only 3.1 per cent, out of which

less than half is under close cover. Bulk of the forests is confined to the districts of Bijnor, Pilibhit and Saharanpur.

Highest priority has to be given to extending the forest cover in the district to atleast 10 per cent of the geographical area. This would mean that apart from the rejuvenation of 2.8 lakh ha. of open forest area, an additional area of 5 lakh ha. has to be brought under afforestation of land under categories like wastelands, pastures and grazing land and fallow lands. In addition well planned schemes should be launched to persuade farmers to take up tree plantation and agro forestry. These efforts will not only help in restoring the environmental balance in the region, but will also meet the basic needs of timber, fuelwood and fodder.

X. Wasteland Development

According to revenue statistics an area of 2.8 lakh ha. is classified as barren and uncultivable land while 1.8 lakh ha. is culturable wasteland, which comes to 3.4 per cent and 2.2 per cent of the geographical area of the region. However, according to our calculations from NRS4 Wasteland Map for U.P. for 1980-82 nearly 10 per cent of the area of the region is affected by the problem of wasteland. The problem of wasteland is relatively more severe in the districts of Agra, Aligarh, Budaun, Bulandshahr, Etah, Gwalah, Farrukhabad, Mainpuri, Mathura and Moradabad.

Out of the estimated area of 7781 Sq. Km. around half (3974 Sq. Km.) is under salt affected area and about one-third (2459 Sq. Km.) is ravinous land. Other categories of wastelands found in the region are sandy areas (1156 Sq. Km.), waterlogged area (152 Sq. Km.) and forest blanks (38.5 Sq. Km.).

Most of the wastelands can be reclaimed with the application of the known technology. The programme of wasteland reclamation should be taken up on a priority basis. Since per hectare cost of reclamation is fairly high, the government has to play an active role directly as well as by providing adequate credit, inputs and technical know how. Primary consideration in wasteland development should be the restoration of environmental balance. Hence preference should be given to programmes of social forestry and agro forestry on the reclaimed wastelands.

XI. Imbalance and Trends in Land Use

The study of landuse pattern in Western Region reveals important imbalances requiring immediate attention of the planners. Cultivation is the dominant land use category covering nearly three fourths of the geographical area. What is a matter of serious concern is the extremely low green cover in the region. Except in the districts of Agra, Bijnor, Etawah, Firozabad and Saharanpur the forest cover has nearly vanished as also area under pastures and grazing land

and area under tree crops and groves. Thus green cover is much below the recommended norm of 20 per cent of total area in the plains for ecological balance. Though the intensity of landuse is quite high, over 10 per cent of the area is under fallows, culturable wastes and non-culturable wastes, which could be put to better use.

There are some noticeable differences in landuse pattern within the region. Broadly we find that in the northern part of the region intensity of landuse is higher and the percentage of area under crop cultivation is larger. In the southern parts, however, area under crop cultivation is relatively lower but area under categories like fallow land and wastelands is larger. These differences in the landuse pattern seem to be related to agro-climatic conditions and availability of irrigation facilities and soil conditions.

The study of the trends in land use over time reveals that area under non-agricultural uses is steadily but slowly increasing. The green cover which is extremely inadequate has further shrunk which is reflected in a decline in area under forests, pastures, tree crops and groves. Area under cultivable and non-cultivable wasteland has shown a steady and marked decline. The extensive margin of cultivation has further expanded in the region unlike in other parts.

Current fallows, however, show a rise, though old fallows have declined.

While there is a broad similarity in the trends in land use across districts some differences in the pattern of shift are noticeable particularly with respect to the current and old fallows and net sown area. Again a north south divide in the pattern of change is observed. While most of the districts in the northern part of the region have witnessed an expansion of net sown area at the cost of cultivable wasteland and current fallows, a group of districts in the southern part comprising the districts of Agra, Budaul, Etah, Farrukhabad and Mathura has experienced a negative shift in net sown area. Expansion of irrigation facilities in these districts will help in a better and more intensive land use pattern.

XII. Proposed Land Use Plan

The major thrust in land use planning for western region of U.P. has to be on (i) the expansion of forests and tree cover to restore ecological balance, (ii) preservation of good quality agricultural land from diversion to other uses, (iii) reclamation of the wasteland, and (iv) improvement of agricultural productivity on a sustainable basis.

The proposed land use for the region for the year 2011 has been worked out keeping in mind the existing land use,

the need for different competing uses and considerations of ecological balance. Table XI.2 shows the existing and proposed land use and the required shifts to be brought about.

Table XI.2 : Proposed Land Use Pattern For West J.P.

Land Use Category	Area in Lakh Hectares		
	Existing Area (1989-90)	Proposed Area (2010-11)	Required shift in area
1. Forests	3.96 (4.81)	8.23 (10.00)	+4.27 (5.19)
2. Barren & Uncultivable Land	2.52 (3.06)	1.23 (1.50)	-1.29 (1.56)
3. Land Put To Non-Agricultural Uses	7.60 (9.24)	8.64 (10.50)	+1.04 (1.26)
4. Culturable Wastelands	1.73 (2.13)	0.41 (0.50)	-1.32 (1.63)
5. Permanent Pastures and Grazing Land	0.22 (0.27)	0.41 (0.50)	+0.19 (0.23)
6. Land Under Miscellaneous Tree Crops and Groves	0.65 (0.79)	1.23 (1.50)	+0.58 (0.71)
7. Current Fallows	2.80 (3.40)	0.83 (1.00)	-1.97 (2.40)
8. Old Fallows	2.28 (2.78)	0.83 (1.00)	-1.45 (1.78)
9. Net Sown Area	60.51 (73.53)	60.48 (73.50)	-0.03 (0.03)
Total Reported Area	82.29 (100.00)	82.29 (100.00)	0.00 (0.00)

Note : Data in parentheses show per cent to total geographical area.

Around 3 lakh ha. area is likely to go to non-agricultural uses over this period. It is suggested that the forest coverage should be extended from around 3 per cent of geographical area to atleast 10 per cent of geographical area. We have also proposed that area under tree crops and groves as well as area under pastures and grazing lands be doubled from about 1 per cent of geographical area to about 2 per cent. This would require a shift of about 6 lakh ha. or 7.4 per cent of geographical area to above land use categories.

The required shifts can be brought about by reduction in area under the following categories : barren and uncultivable land (1.56 per cent points); current fallows (2.40 per cent point); and, old fallows (1.78 per cent point). Net sown area can be maintained at 78.5 per cent of geographical area, but a part of it should be diverted to agro forestry and horticulture. Requirement of more food have to be met by raising the productivity and intensity of land use.

In short, action plans covering the period for the next 15 to 20 years have to be prepared to attain to following targets to ensure an optimum land use pattern for Western U.P. :

1. Restoration of 3 lakh ha. of degraded forest lands.
2. Afforestation over an additional area of 4.5 lakh ha.
3. Reclamation of 1.5 lakh ha. of wastelands.
4. Development of 0.5 lakh ha. of pastures and grazing land.
5. Additional area of 1 lakh ha. under horticulture, tree crops and agro forestry.
6. Bringing 30 lakh ha. of additional area under multiple cropping to bring intensity of cropping to 200.
7. Additional irrigation potential of 25 lakh ha. 15 lakh ha. through surface schemes and 10 lakh ha. through ground water exploitation.

Scientific management, conservation and development of land resources requires an integrated approach to land, water and vegetation. The activities of various related departments such as Forest, Revenue, Irrigation, Agriculture, etc. have to be properly coordinated from this angle. Appropriate institutional set up has to be created at different levels for land use planning. There is an urgent need to make the state Land Use Board an effective policy formulation and coordination body with adequate powers, staff and resource. At the district level a District Land Use Committee should be set up, which will operate within the overall direction of the District Planning Board and will be vested with the task of preparing land use plans in the